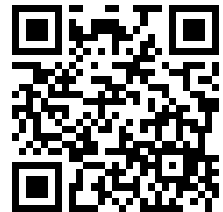

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Royal Army Medical Corps

EDITED BY

COLONEL G. W. WILL, *O.B.E.*

ASSISTANT EDITOR :

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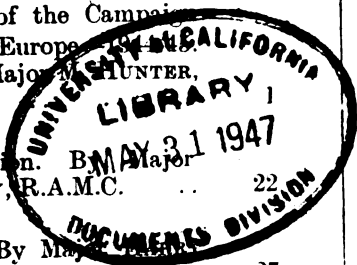
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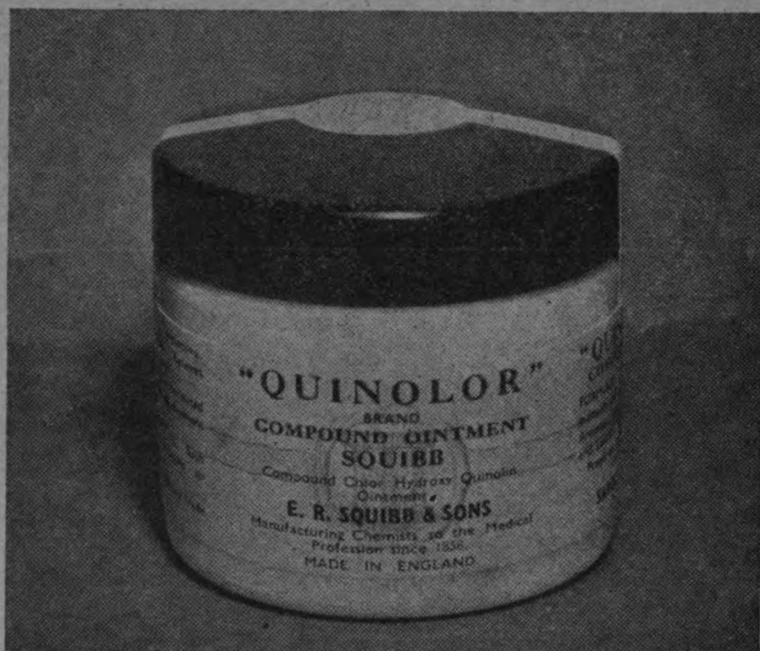
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Journal of the Royal Army Medical Corps.

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HYGIENE PROBLEMS OF THE CAMPAIGN IN NORTH-WEST EUROPE—1944-45.¹

A REVIEW.

BY

Major M. HUNTER,
Royal Army Medical Corps.

[Received October 31, 1946.]

THE following quotation is from a lecture given by Field Marshal Montgomery to the Royal United Service Institution in London on October 3, 1945.

"No account of this campaign would be complete without some mention of the truly remarkable success of the medical organization. But it must be remembered that there were two factors which contributed greatly to the results achieved; probably no group of doctors has worked on better material and, secondly, they were caring for the men of a winning army. The men of 21 Army Group were fully immunized and fully trained; their morale was at its highest; they were well clothed and well fed; they were fighting in a climate to which the average British soldier is accustomed; hygiene, both personal and unit, was exceptionally good; welfare services were well organized. The exhilarating effect of success also played its part in reducing the rates of sickness."

The various factors contributing to the "remarkable success of the medical organization" have been described from the purely medical and surgical aspects by Bulmer (1945) and by Porritt, Debenham and Ross (1945). But,

¹A thesis submitted for the Degree of Doctor of Medicine of the University of Edinburgh and published with their approval.

apart from articles on isolated incidents such as Belsen, no attempt has been made to give an overall picture of the preventive medicine and epidemiological aspects of this campaign.

HISTORY.

Very briefly, this can be divided into four phases. The overcrowded Normandy Beachhead and its gradual enlargement were associated with unpleasant weather, dust, flies, and large-scale destruction of towns and villages.

Water supplies and sanitation were therefore of the greatest importance and were tackled energetically from the very first day of the landings. The disposal of dead animals was also a problem in some areas, but not insoluble when flames, explosives and bulldozers were available.

The SECOND PHASE started with the leaving behind of the Falaise "pocket" with its masses of enemy dead—human and animal—and covered the rapid advance across the Seine to Antwerp, Brussels and Nijmegen.

The THIRD PHASE covered the autumn of 1944 and the winter of 1945. Snow, bitter cold and heavy rain were experienced in Holland, Eastern Belgium and across the German border.

Operations in the Reichswald Forest became, of necessity, amphibious in places but the advance went on towards the Rhine.

FINALLY, there were the Rhine crossings and the rapid advances to the River Elbe and the Danish Border. This period covered the disintegration of the German Army in a completely disorganized society in a devastated country, the uncovering of the horror camps of Belsen and Sandbostel, and the disposal of vast numbers of ex-prisoners of war, displaced persons and refugees. The problems involved will be discussed in subsequent paragraphs.

PREPARATION AND ORGANIZATION.

It has been already stated that the men of 21 Army Group were fully immunized and fully trained, and that they were well clothed and well fed. Immunization was provided against typhoid, paratyphoid, tetanus and typhus. The results speak for themselves for only twenty-five soldiers out of the whole Army Group contracted typhus and only one outbreak of enteric occurred.

Experience in the Middle East had emphasized the great part which hygiene played in reducing the incidence of disease and units from that theatre were definitely "hygiene conscious." Units leaving England for the first time had not had this experience other than on short exercises, but their water and sanitary duty personnel were fully trained, and their divisional field hygiene sections were always on the spot to give help and advice. Clothing, equipment and feeding, although not on a lavish scale, were very satisfactory throughout the campaign and for the organization of these supplies great credit is due to the Royal Army Service Corps and Royal Army Ordnance Corps.

The organization of preventive medicine in B.L.A. was built up on experience of past campaigns. As the most forward R.A.M.C. representative,

the Regimental Medical Officer was responsible both for the health of his men and for their treatment when sick or wounded.

To assist him, Field Hygiene Sections were provided on the scale of one per Division, with additional sections at Corps and Army level.

A.Ds.H. at Corps and Army Headquarters supervised the work of these sections, whilst field sanitary sections were employed at Base and L. of C. under the supervision of D.A.Ds.H.

Overall direction of hygiene matters rested with D.D.H. at Army Group level, and he also controlled the mobile hygiene and bacteriological laboratories.

In practice this organization worked well. All sections were fully mobile, moving with their formations; and although perhaps wasteful of man-power in some respects, the organization ensured that hygiene problems could be dealt with immediately they appeared.

PRACTICAL ASPECTS.

(1) *Water Supplies.*—As might be expected, the provision of adequate supplies of water for drinking, cooking and ablutions was not a serious problem in N.W. Europe.

There was always the possibility that the enemy might use poison gas or, alternatively, poison the water supplies. Fortunately this did not happen although R.E. and Medical Services were fully prepared to deal with it if it had occurred.

Certain other difficulties did however arise.

In the confined Normandy Beachhead the rivers were few and their water used by very large numbers of troops. Close supervision was essential to prevent their becoming so polluted that they were unfit for drinking even with the treatment facilities available. In parts of Belgium waters with a very high iron content made chlorination difficult. Freezing of filters had to be closely watched in winter. Bombing, whether our own or the enemy's, was always liable to affect civilian supplies which were so largely drawn upon.

The methods used for sterilizing water were as follows :—

(a) Every soldier who required it was issued with a water sterilizing outfit containing Halazone tablets and detasting tablets. A Halazone tablet liberates 4 parts per million of available chlorine, and one tablet will sterilize the contents of the soldier's water bottle. There is some loss of potency with storage, but the tablets were checked from time to time, and orders for the insertion of two tablets given when necessary. With such a water-sterilizing outfit the soldier was not dependent on water trucks or jerricans, when in forward positions where movement was difficult or impossible.

(b) Water trucks of 200-gallon capacity complete with testing boxes, filter powder, water sterilizing powder and taste remover tablets were supplied to battalions, regiments and units in accordance with their War Establishment. These trucks were fitted with power-operated pumps and Stellar filters and had a filtration capacity of 400 gallons per hour. Water tank trailers of 150-gallon capacity were supplied to some units, but their pumps have to be operated by

hand. This is a tedious business and such trailers were filled at R.E. water points whenever possible.

(c) R.E. water points were usually sited in Corps and Army areas, and were either mobile (trailer type) or static chloraminators. Mobile chloraminators have a capacity of 3,000 gallons per hour; static ones a greater capacity depending on the number of chloraminators installed at the point. The sterilized water was collected from these points in trucks, trailers and jerricans.

(d) Jerricans were also used by small units or detachments. The procedure was to fill the 4½-gallon jerricans from the best available source and treat the contents by gross chlorination with water sterilizing powder followed by detasting tablets.

Unit medical officers and personnel of Field Hygiene Sections kept a close check on the sources from which water was drawn and on the methods of treatment which were employed. Results were most satisfactory and no outbreak of waterborne disease occurred throughout the campaign. Some few cases of enteric were probably caused by drinking impure water or cleaning teeth with it; but these cases were always the result of negligence on the part of the individual and were not due to any lack of sterilized water.

(2) *Sanitation*.—The provision of latrines, disposal of refuse, sullage, and effluents from mobile laundry and bath units followed the accepted Army principles and call for no special comment. Continuous supervision was exercised by sanitary assistants, the amount of supervision that was required varying inversely with the efficiency of a unit.

(3) *Rations and Feeding Problems*.—During the period 1939 to 1944, the Army gained much experience in the provision of rations suitable for different types of operations and climates. As a result of this the troops operating in N.W. Europe received the following types of rations:—

(a) *The Twenty-Four-Hour Ration Pack*: This contained biscuits, oatmeal blocks, combined tea, sugar and milk blocks, chocolate, boiled sweets, chewing gum, meat extract cubes, salt, sugar and latrine paper. This ration weighed 2 lb. 3 oz., was packed in a waxed cardboard carton, and gave a nutritive value of approximately 4,000 calories. A solid fuel cooker for preparing this ration was an individual issue to each man, and 20 cigarettes were issued for each forty-eight-hour period. As a landing or assault ration to be consumed for not more than ten days it was very satisfactory.

(b) *The Composite (14 Men) Ration Pack*: This pack was produced to cover a period of up to six weeks between the landings and the introduction of the ordinary field service ration. It was made up entirely of tinned commodities with variations to allow for a daily change of diet throughout the week. Seven varieties of "Compo" were available with biscuit, and three varieties for issue when fresh bread was available. Cooking facilities must of course be available under unit arrangements. The Compo pack with biscuit provided approximately 3,590 calories per day, and the Compo pack with bread approx. 3,520 calories. Compo packs were well liked at first, but as the weeks went by the variations appeared to decrease, due either to difficulties in supply or to lack of imagination. The chief complaints concerned the number of stewed

meats and puddings which had a high fat content and which to many became unpalatable in summer, whilst biscuits were a very poor substitute for bread when eaten over a long period.

(c) *Field Service Ration Scale* : This scale succeeded the "Compo" period and was very similar to the ration provided for troops in U.K. Owing to difficulties in supply or local procurement there were variations in the issues of fresh meat and fresh vegetables, but on the whole it provided an adequate, balanced, and reasonably attractive menu. Allowing for 5 per cent waste it provided approximately 4,080 calories, and a supplementary ration of 400 calories was available for troops working under arduous or exposed conditions. 3,400 calories were provided for Women's Services.

(d) Self-heating beverages (soups, cocoa, malt milk) were also available and invaluable for troops holding difficult or waterlogged positions, or under conditions of extreme cold. Armoured fighting vehicle packs and airborne packs were available for special purposes, as their names imply, but lack of space prohibits a detailed description.

Milk was provided as tea, sugar and milk mixture, or in tins or powder form. If bought in the raw state from farms, orders were issued that it must be boiled before use. Orders were also issued prohibiting the purchase of shellfish and ice-cream with the object of keeping the incidence of intestinal diseases to a minimum.

(4) *Personal Hygiene*.—Realization of the importance of personal cleanliness in promoting general bodily health and preventing skin diseases is now widespread throughout the Army, and unit commanders are aware of their responsibilities in this matter. Bathing and laundry arrangements for the troops were based on the provision of mobile laundries and bath units (M.L. and B.U.s). M.L. and B.U.s were under command of Corps but during operations one worked for each Division. In theory each M.L. and B.U. could provide a clean issue of underclothing and a shower bath for every soldier once a week. In practice this was not always possible because of operations, but as the bathing unit could operate in four separate sections, and extensive use was made of pit-head baths and improvised showers, etc., it is probably fair to say that on the average every soldier would have a bath and a change of underclothing every ten to twelve days, or more frequently than that. In addition to ordinary laundering, the M.L. and B.U.s impregnated shirts with A.T.S.O., a solution of D.D.T. (dichlorodiphenyltrichlorethane) which would kill any lice hatching from eggs. Anti-louse powder (A.L. 63) containing 5 per cent D.D.T. was also available for sprinkling on underclothing and rubbing into the seams of shirts, etc. The result of these efforts was to reduce louse infestation to a negligible figure; and of the cases of infestation which did occur, the vast majority were due to *P. pubis*. The incidence of skin infection was also kept well under control.

Before leaving the subject there are two points worthy of mention, and criticism.

The first is soap, of which 2 ounces had to be bought from N.A.A.F.I. every fortnight. This was insufficient for those soldiers employed in dirty

jobs, and there was sometimes delay in its distribution. Two ounces of soap per week were available as an Ordnance issue for troops to do their own washing where M.L. and B.U.s were not available. As might be expected, drying of this laundry under field conditions was often difficult, although many units were able to make improvised drying rooms when operations permitted. Some use was made of hot air disinfestors which had fallen into disuse with the introduction of A.L. 63, both for drying of laundry and for drying the clothing of the infantry soldiers returning from the front after periods of bad weather or the occupation of waterlogged positions.

The last point of criticism is "ointment prophylactic," issued to mechanics and fitters for the prevention of dermatitis. It was rarely available in sufficient quantities.

(5) *Effects of Cold*.—In the War of 1914-18 the incidence of trench foot was 0.503 per thousand. In the period under review (1944-45) it was 0.049 per thousand, although it would probably be more accurate to-day to ascribe this incidence to injuries due to cold. This low incidence is really rather remarkable, for it is much lower than that experienced by the Americans fighting under similar conditions and, so far as could be ascertained from interrogation of prisoners of war, very much lower than that of the German Army. The condition occurred mainly (a) in the Ardennes when snow and intense cold prevailed, where British troops were waiting for rather than engaging the enemy. Two-thirds of the cases reported there were very mild and, after treatment in forward medical units, returned to duty; (b) in the Reichswald Forest offensive between the Rivers Maas and Rhine. This offensive was conducted through half-flooded or waterlogged country, and in some places it became an amphibious operation. It is not possible to discuss the effect of cold in detail in this article, but the measures taken to combat them may be summarized as follows :—

(a) *Tactical Handling of Troops*: Periods of alternating activity and reserve in an advancing front; or the withdrawal (as frequently as possible) of all elements for purposes of warming during periods of intense cold.

(b) *Foot Drill—Foot Inspections*: The frequent massaging of the feet either by the soldier himself or a companion. Constant movement of toes and feet when in a static position. The use of foot powder and foot soap: both were issued when conditions indicated it.

(c) *Socks*: The superiority of the British sock with its higher wool content; its frequent changing when wet for dry socks carried by the soldier, or provided for him by the use of improvised dryers.

(d) *All-Leather Boots*: The provision of sound, well-fitting, and well-dubbed boots. Rubber boots worn with two pairs of socks were especially valuable for sappers, sentries and signals personnel.

(e) *Canvas Anklets*: Although not giving the same protection, did not constrict the legs and circulation like puttees or leggings.

(f) *Dress*: Woollen battledress combined smartness with warmth and

looseness of fit. Leather jerkins or denims worn over the battledress gave increased protection without restriction of arm movements.

(g) Food : Troops could usually depend on one hot meal per day after the first day of the attack. This was brought from the rear areas in insulated containers and re-heated as necessary. Self-heating soup, cocoa or milk was also available, but the genius of the British soldier for "brewing-up" tea in almost any place or at any time of day (or night) undoubtedly played a very great part in the preservation of their morale and their physical condition.

(5) *Training*.—As the period under review was one of continuous fighting, and as 21 Army Group was within easy access of training establishments in the U.K., it was not considered practicable to establish a hygiene school in the theatre until operations had ceased. Field Hygiene Sections did, however, give courses of instruction in water duties and in sanitary duties when operations permitted them to remain in the same location for short periods. Casualties amongst water and sanitary duty orderlies were thus replaced by men from the same unit, and war establishments and reserves maintained.

General training in sanitation was also given in the L. of C. to a considerable number of low medical category Royal Artillery personnel. When trained they were posted to Field Hygiene Sections and proved of great value, particularly for work in D.P. and ex-P.o.W. Camps in Germany.

(6) *Accommodation*.—In the Normandy Beachhead all troops were in bivouacs in the ground or under canvas but, with the onset of winter and the occupation of Belgium, Southern Holland and the eastern border of Germany, units were scattered over a wide area. In this area it was possible to accommodate the majority of the "non-fighting" troops in schools, factories, houses, barns, lofts, etc., and to provide reasonable accommodation for fighting troops when they were withdrawn from forward positions for rest and refitting.

A scale of 30 sq. ft. per man was aimed at, and although local overcrowding was at times unavoidable, there was no undue rise in the incidence of droplet infections. It was necessary to enforce "black-out" restrictions throughout this period, and as "black-outs" were frequently improvised, ventilation before "lights-out" and the removal of screens, shutters, etc., was sometimes inadequate.

After the crossing of the Rhine in March, 1945, movement was almost continuous for many units and tentage was used again. For those units moving more slowly there were plenty of buildings available, and as these buildings were German, occupation was effected without formality. The chief problems associated with accommodation were as follows :—

(a) *Overcrowding* : To ensure that there was no gross overcrowding and that the best use was being made of all available accommodation.

(b) *Water Supplies* : Some soldiers will always remain under the impression that if water comes out of a tap it is quite fit to drink. As it frequently came from a shallow well in an adjacent farmyard, it was important to ensure that chlorination by any of the methods previously mentioned was always carried out.

(c) *Sanitation* : In many of the buildings occupied, the sanitary arrangements were quite inadequate for the number of soldiers residing there. Deep trench and bucket latrines were often required to supplement existing facilities.

(d) *Hygiene of Surroundings* : This required constant attention, for, when units received orders to move at short notice, the sites they vacated were often left in a most disorderly state. Such sites, having been chosen for their suitability (cover, water, easy access, etc.) will inevitably be the choice of units following on, and will eventually become very foul unless all units keep and leave them reasonably clean. Occupation of towns which had been heavily bombed or shelled also brought its problems, and accumulations of debris, and damaged water mains and sewers required watching closely lest they became a danger to the health of the troops.

(e) *Carbon Monoxide Poisoning* : Experience in the B.E.F. in France in 1939-40 had pointed out the dangers of this insidious and often fatal type of poisoning. Despite repeated instructions and orders, cases did occur in the winter months of 1945, usually when troops advanced to occupy fresh billets and decided to install stoves of their own initiative. Such stoves were either improperly constructed or had defective flues, and these defects in combination with inadequate ventilation caused a number of deaths.

CIVILIAN FEATURES.

(1) *Refugees*.—In comparison with other campaigns, the refugee problem in N.W. Europe was a small one. In Normandy many civilians lost their homes, their whole village or the major part of their town (e.g. Caen). Others had to be temporarily evacuated. Corps refugee camps were established and movement controlled by Civil Affairs Staffs until more permanent accommodation could be found. Similar arrangements were made in the area between the Rivers Maas and Rhine. Destruction of property in this area was very great, and an enormous number of troops had to be packed into it prior to the Rhine crossings. Civil Affairs had by now changed its name to Military Government, and was a much more powerful organization. The local inhabitants (Germans) were assembled and kept in selected areas until such time as it was expedient to allow them to return to their homes. The mere mention of these two areas may give a false impression of the refugee problem, and certainly does not do justice to the work of the Civil Affairs and Military Government Staffs. For, wherever there is fighting, there are inevitably refugees obstructing the progress of the Army. The fact that such obstruction was minimal is in itself a tribute to the immense amount of work which these Staffs dealt with so successfully.

(2) *Displaced Persons*.—This problem started after the Rhine crossings, as the Germans evacuated their slave labourers from Belgium and Holland before the Allies reached their camps. Once across the Rhine there was neither the time nor the transport for further movement.

Officially there were two types of displaced person, although both types were nationals from other countries working in Germany either voluntarily or involuntarily. The first type came from Poland, Russia, Italy and the

Balkans and the plan was to keep him as far east and as near his homeland as was possible under the circumstances. The second type came from a country west of the Rhine, and he had to be sent home just as fast as transport facilities permitted. The total number of displaced persons to be dealt with was over two millions. Transport was, of course, the great difficulty, for all the bridges over the rivers and canals had been "blown" by the retreating enemy: the R.A.F. had played havoc with Germany's worn-out communication systems: and the Army was still busy fighting the battle up to and across the Elbe.

A system of camps was therefore set up to hold the D.P.s until transport could be arranged for them. The camps were set up on the River barriers (Rhine, Weser and Elbe) with the idea of preventing the eastbound D.P.s from filtering to the west, and of retaining the westbound until they could be evacuated through organized channels.

The establishment of such camps for hundreds of thousands of people would have been an immense problem under peacetime conditions, and it can be well imagined that to establish and operate them in a completely disorganized country during a war was really a tremendous feat.

The difficulties of accommodating, feeding, lousing and providing medical attention, water, sanitary arrangements, and bedding for such a mass of humanity must be left to the imagination. Accommodation was first priority and this was made available in barracks, camps, factories, houses or even whole villages. Other necessities, if not immediately available, were provided as rapidly as possible by staffs who worked all hours of the day and night. Fortunately it was summer, and the D.P.s flocking westwards from all over Germany were neither critical nor involved in an epidemic. Those due to go east could not be repatriated immediately but better accommodation was available for them once the Westerners had gone. During the whole of this period of repatriation and resettlement the Army Medical Services gave all possible assistance to the Military Government Camp Staffs. Field Hygiene Sections probably worked harder than at any time during the campaign, and it is very satisfactory to be able to report that there were no major outbreaks of disease, and very few cases in which infection was carried to countries outside Germany. Providentially "V.E." day occurred at the beginning of summer. Had it occurred six months earlier or later, this story of the D.P.s would have been a much less happy one.

BELSEN AND SANDBOSTEL.

(1) *Belsen* is a name which will go down in history, and although much has been written on the medical and legal aspects it should be remembered that it was first and foremost a hygiene problem.

The first Army unit to enter Belsen was the 76 (Br.) Field Hygiene Section, and it spent the first night there under the "care" of the German guards, on April 15. Other Army units soon followed it, including the 30 (Br.) Field

Hygiene Section. Intelligence had notified 8 Corps of the existence of this camp, of the presence of disease, and of the failure of electricity and water supplies. No one, however, could have imagined the conditions which actually existed there : and these conditions could be neither believed nor appreciated by anyone who had not seen them with his own eyes. Approximately 38,000 men and women and 500 children were living under indescribably squalid and overcrowded conditions. The majority had lost all sense of moral values and cannibalism existed. There were enormous pits full of bodies, and more bodies lying either in heaps or singly throughout the two camps. Hospital accommodation was grossly inadequate, and typhus, enteritis and tuberculosis were widespread. Sanitary arrangements were practically non-existent. Even if they had been it is doubtful whether the inmates would have had the strength or decency to use them. It is not possible in this article to describe in detail the steps taken to deal with Belsen, but the chief problems were as follows :—

(a) Provision of drinking water : Twenty-seven water trucks were provided by the afternoon of April 16 as a temporary measure until R.E.s repaired the electrical and water supply systems.

(b) Provision of food : The R.A.S.C. arranged supplies from Military, Wehrmacht and Civilian sources. Initially, some of it was not suitable for the sick and starving inmates, but the best use was made of what was available.

(c) Disposal of the sick : Hospitals were opened in the neighbouring S.S. barracks, and all patients conveyed there were passed through a "human laundry" where they were thoroughly washed and dusted with anti-louse powder.

(d) Burials : Between April 16 and 30 approximately 12,000 were buried in Camp No. 1, and 500 in Camp No. 2 and the hospital area.

(e) Dusting with A.L. 63 : Approximately 36,000 were dusted during the same period covered by para. (d).

(f) Bathing : Thousands were bathed by mobile bath sections and in bathrooms as soon as sufficient water was available.

(g) Latrines : 730 squatting type latrines each with four or five apertures were made and installed.

These paragraphs will give a slight idea of the difficulties encountered and overcome. The danger to those working in such camps is obvious, and will be mentioned in a later paragraph under "Typhus."

(2) *Sandbostel* was a camp north-east of Bremen containing approximately 7,000 political prisoners and 15,000 United Nations P.o.W.s. Conditions were not so appalling as at Belsen but there were 791 cases of typhus, almost all amongst political prisoners. Much the same routine was followed as at Belsen, i.e. dusting with A.L. 63 after passing through a "human laundry," attention to sanitation, and evacuation of the sick to near-by hospitals.

(3) The camps at Fallingbostel and Neuengamme were also very unpleasant places, but did not present anything like the same problems as existed in Belsen and Sandbostel.

EX-PRISONERS OF WAR.

During the period April 4 to May 4, 1945, 93,844 ex-P.o.W.s were uncovered in the British zone of operations in Germany. Of this total, 16,787 were from the British Empire, 4,270 were Americans, and the remaining 72,787 were of other nationalities, including Russians, Belgians, Yugoslavs, French, Polish and Italians. As their camps were uncovered, a plan similar to that used for displaced persons was put into operation. Collecting and transit camps were provided for the westbound ex-P.o.W.s, and they were accommodated, fed, given new clothing, and dusted with anti-louse powder whilst awaiting transport. Air transport was used on a large scale and, operating from airfields inside Germany, each plane had its complement of ex-P.o.W.s back in England within a matter of hours. Some few of these ex-P.o.W.s developed typhus after arrival in U.K., Belgium and France, but so far as is known there were no secondary cases. Repatriation of the eastbound ex-P.o.W.s was inevitably delayed until travel facilities with Russia, Italy, etc., could be established. These ex-P.o.W.s had therefore to remain in their camps or be moved into better accommodation. Their food, clothing, comfort and amenities were improved as rapidly as possible; attention given to bathing, camp hygiene, etc.; and regular dusting with anti-louse powder instituted. It was not an easy task to improve the lot of this class of officer ex-P.o.W., for many of them had done literally nothing for three, four or five years and seemed quite apathetic. In that respect they were worse off than the other rank ex-P.o.W.s who probably had a more unpleasant life, but they always had the stimulus of work and the necessity of fending for themselves. Many of these eastbound ex-P.o.W.s (and D.P.s) still remain in the British zone of occupation for political reasons. Discussion of their future is not within the scope of this article, but since the uncovering of their camps they have been a great responsibility for the Army from the hygiene and preventive medicine aspects, and it is only now (some months after V.E. day) that this responsibility is being taken over by U.N.R.R.A.

PRISONERS OF WAR.

This subject is mentioned because the number of P.o.W.s taken by 21 Army Group was very large, and their accommodation was often a considerable problem. The routine was that after capture, the German P.o.W.s were passed back to cages at Corps level and retained there for a short period until transport was available for their transference to Army and L. of C. Camps; or to the U.K. in the early days in Normandy. It was a hygiene responsibility to see that these P.o.W.s were efficiently "loused" with A.L. 63 at Corps level, and to ensure that the standards of food, water supplies, sanitation and accommodation in the camps were adequate. As the intake of P.o.W.s could never be estimated in advance, these standards often varied and were at times too low. In fact, when the cease fire was ordered on May 5 it was not considered advisable to put all the P.o.W.s "into the bag." They were therefore "sealed

off" in areas along the North German Coast and ordered to look after themselves (under British supervision) until demobilization could be arranged.

THE INCIDENCE OF DISEASE.

(1) *Enteric*.—The mean monthly rate per thousand strength was 0.007 compared with a figure of 1.525 for the 1914-18 War. It would have been much lower but for an outbreak of *B. typhosus* infection which occurred in an armoured brigade in the early autumn of 1944. This outbreak has been described by Jordan and Jones (1945) and was a serious one. Of seventy-nine men and one Nursing Sister who contracted the infection eleven died. Complications and recrudescences were frequent. Despite exhaustive investigations and full use of a mobile bacteriological laboratory the origin of the outbreak was never discovered. It was made more difficult by the fact that the brigade changed its location and crossed the Seine before the first cases were finally diagnosed, and before it could be halted for full investigations to be carried out. Bulmer (1945) states "the efficiency of T.A.B. is not in dispute (our typhoid rate was 1/200 that of the B.E.F. 1914-18) but if patients are overwhelmed they will contract the disease, and apparently in an unmodified form."

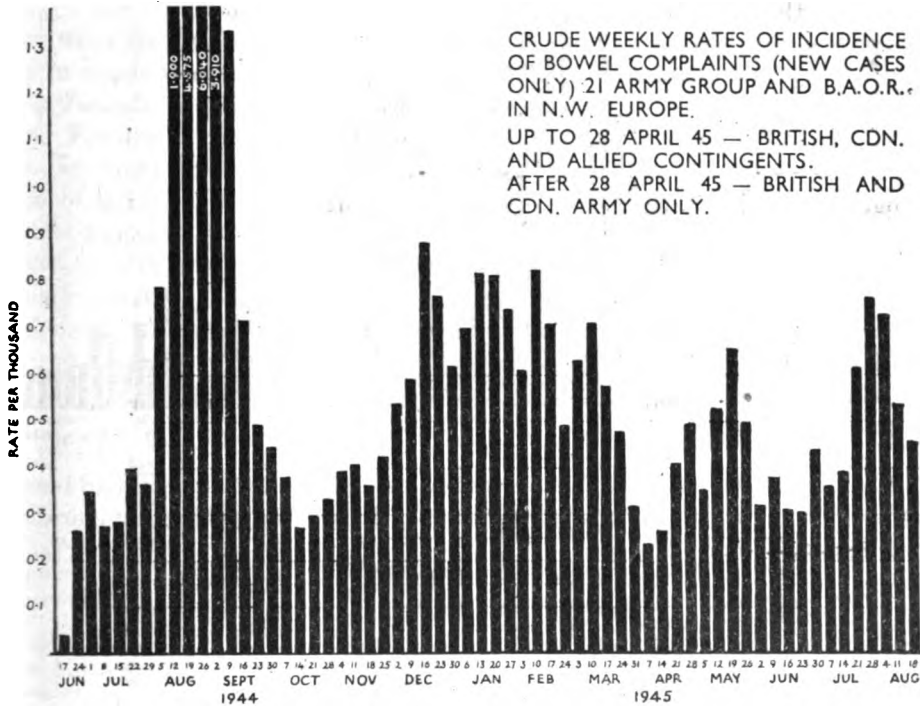
Dysentery.—Fortunately, almost all these cases were mild or very mild; many remained on duty, either treated or untreated, and few were evacuated to hospitals where bacteriological facilities were available.

August 5 to September 9, 1944, was the worst period, for during that time rates per thousand of 1.90, 4.57, 6.04 and 3.91 were recorded under the heading of "bowel complaints." During this period the disease was largely spread by flies, but, almost certainly, to a lesser extent by food handlers. June and early July were unusually cold in Normandy and the fly season delayed. When it did arrive conditions were all in favour of fly breeding, for there had been intense fighting and great destruction in a small, largely agricultural area.

It is less easy to explain the incidence of "bowel complaints" which varied between 0.6 and 0.8 per thousand during December, 1944, and the following January and February. There were no flies at that time and the condition was more a mild gastro enteritis than a frank dysentery. Those cases which were examined bacteriologically yielded negative results, and this disease would appear to be similar or closely related to outbreaks which have been reported in the U.K. by Barnard (1945) and in America by Reimann (1945). Units affected did not experience an explosive outbreak and the possibility of any type of bacterial food poisoning could usually be excluded. In the absence of any proof of a virus infection, carriers may be held responsible.

W. M. Scott (1942) states that the persistence of dysentery in a normal community is sufficiently explained by the frequent occurrence of mild undetected cases capable of transmitting infection for a period of weeks, or even exceptionally, for some months, while leading their ordinary life. In addition to mild cases, dysentery carriers (and there must have been many after the Normandy epidemic) may continue to excrete the organism for

weeks after clinical recovery : and healthy contact carriers are always found in any outbreak (*Brit. Med. Journal*, 1944). It seems reasonable to suppose that the incidence in winter was due to these factors combined with a diminishing immunity of the population at risk. Risk is the appropriate word, for sanitation and the hygiene of cooks, cookhouses, etc., cannot always be perfect during a battle. Under the circumstances chemoprophylaxis with

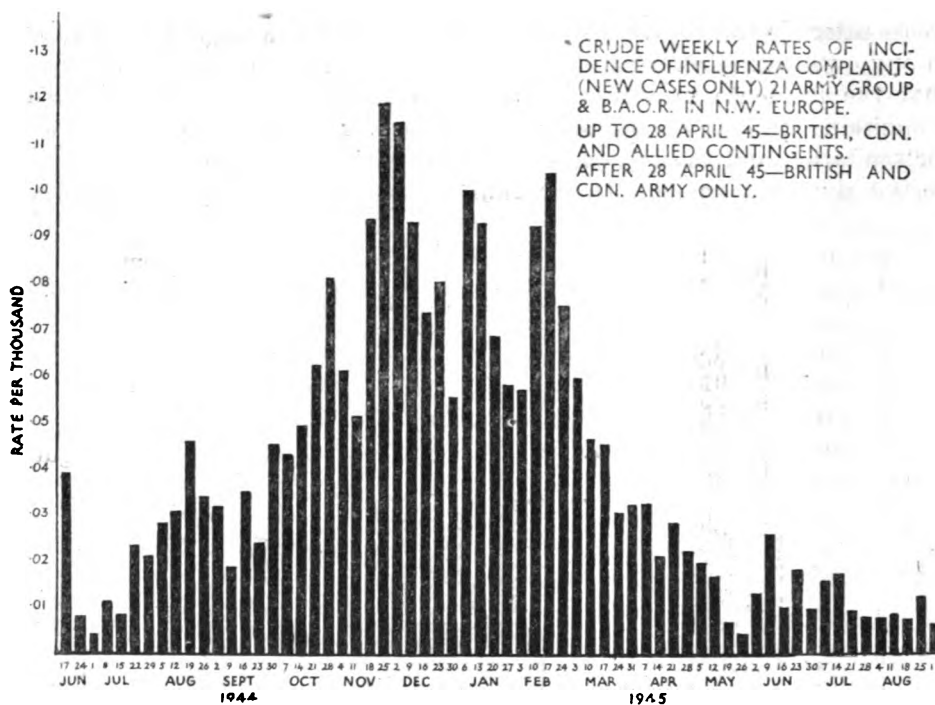


sulphonamides seems justifiable, and its use is advocated in the Medical Research Council War Memorandum No. 10 (1945 edition).

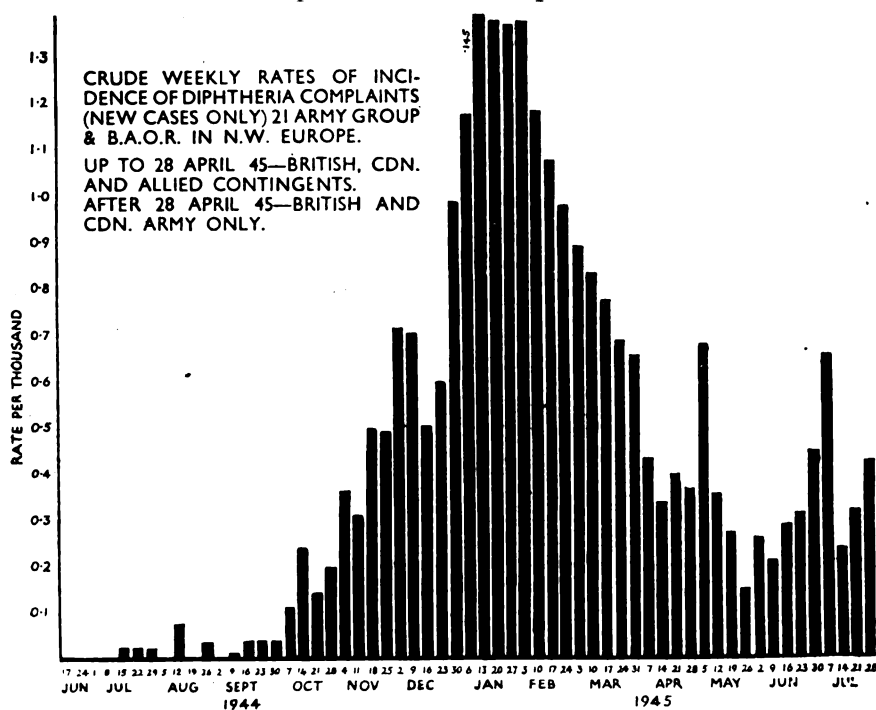
(3) *Pneumonia*.—A mean monthly rate of 0.068 per thousand compared with 0.419 for the 1914-18 War. Sporadic cases only occurred, and the decreased incidence is certainly due in part to correct diagnosis—i.e. radiography and increased knowledge of chest diseases.

(4) *Meningitis*.—The monthly rate was 0.007 per thousand. Stocks of sulphathiazole were on hand for the prophylaxis of this disease, but they were never required.

(5) *Influenza*.—Accurate diagnosis of this condition by the examination of sera and garglings was not attempted because there was no call for it. The mean monthly incidence of conditions labelled "Influenza" was 0.253 per thousand, this being rather more than one-quarter of the incidence in 1914-18. The incidence was highest during the period mid-November to mid-February.

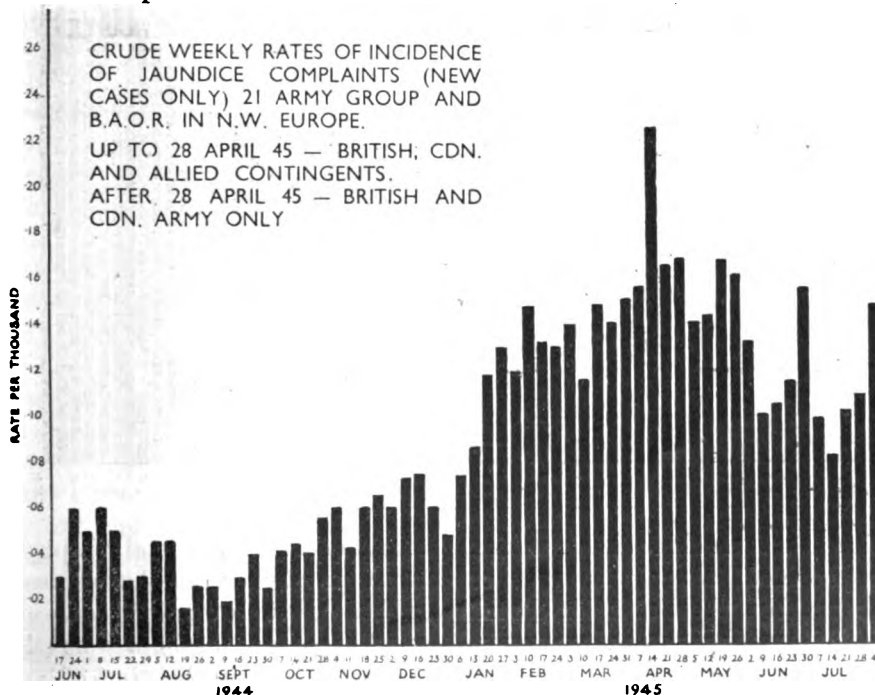


(6) *Diphtheria*.—Stuart (1945) states that from 1941 there had been in Northern and Central Europe an increase in diphtheria incidence unparalleled



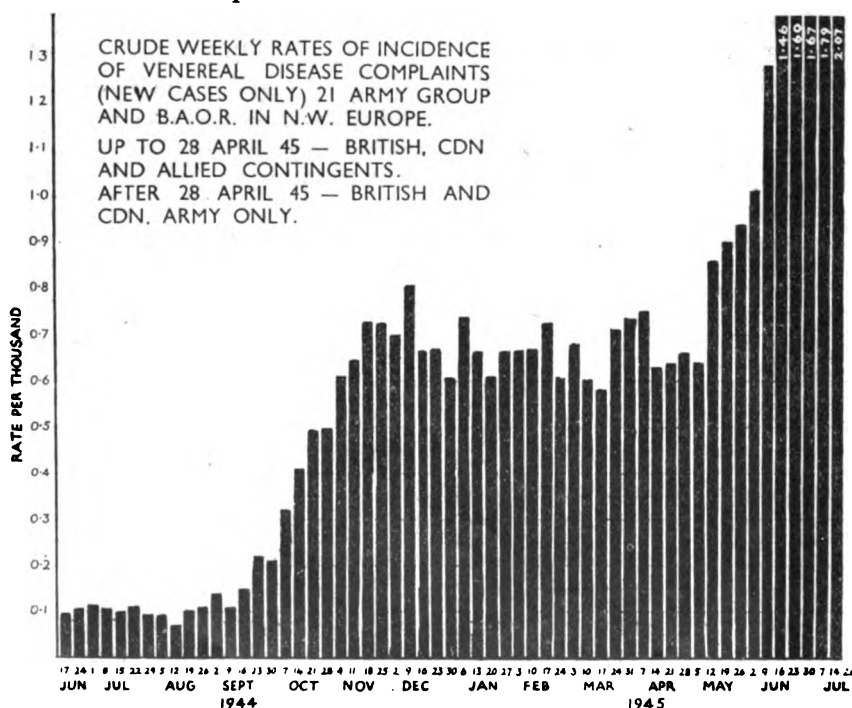
since control of the disease became possible. Since it was not practicable to institute an immunization scheme it was inevitable that some troops would contract the infection when they had opportunities for mixing with civilians and entering their homes. These conditions existed from mid-autumn, 1944, and the incidence of diphtheria in the Army increased steadily to a maximum of 0.145 per thousand per week in mid-January. After four weeks the incidence gradually declined to 0.015 per thousand at the end of the campaign. Practically all cases investigated showed that the infection was obtained from civilians rather than from other soldiers. There were a number of deaths due either to delay in reporting sick or to an unusually virulent infection.

(7) *Jaundice*.—(a) Infective hepatitis was present throughout the campaign. For the first six months the incidence varied between 0.020 and 0.075 cases per thousand per week. In subsequent months the rate was in the region of 0.15, with a maximum of 0.225 in mid-April, 1945. These figures were not unexpected as there has been a steady rise in the incidence of infective hepatitis during the past four autumns (Witts, 1944). The position must, however, be regarded as unsatisfactory whilst we are without any method of prophylaxis against a disease which, although very rarely fatal, is a serious drain on man-power and a strain on medical facilities.



typhosa (Buckland and Stuart, 1945)—a strain of leptospira spread by continental water voles, which produces an attack of Weil's disease without jaundice.

(8) *Venereal Disease*.—A mean monthly rate of 2.116 compared with 2.474 in the 1914-18 war is a sad record and implies that the present war has "put back the clock" twenty years so far as V.D. is concerned. It should, however, be noted that these figures are for all troops under command of 21 Army Group. The incidence amongst British troops was relatively low—at least until the campaign ended and fraternization was permitted. During the first four months the incidence was approximately 0.1 per thousand, but with the advent of more static conditions there was a steady rise throughout October and November to 0.70 per thousand. Thereafter the rate varied between 0.6 and 0.75 per thousand until hostilities ceased.



soldier patient. This entailed much work for the various authorities—Medical, Provost, Civil Affairs (Military Government) and Civil, but it gathered in for treatment a considerable percentage of women who would otherwise have continued to spread the disease. Throughout the campaign penicillin was used for the treatment of both gonorrhœa and syphilis. Its use produced an enormous saving in time, transport and man-power, for treatment could be completed in an average of fourteen days for syphilis and twenty-four to forty-eight hours for gonorrhœa. Uncomplicated cases could be treated in forward medical units (usually at Corps level) or in General Hospitals in Base and L. of C., in the certain knowledge that there would be very few relapses, and that the men were being rendered non-infective very rapidly.

(9) *Typhus*.—This disease might have been omitted were it not for the fact that twenty-four members of the British Army contracted it whilst working at Belsen and one (a medical officer) at Sandbostel. “No lice, no typhus” is essentially true, and as the Army was not lousy (*see* paragraph 10) it may be of interest to consider how infection was acquired. Those who were infected were working amongst hundreds of cases of typhus in filthy dust-laden buildings. They were dusted with anti-lice powder most religiously, bathed regularly, but not all were swathed in completely protective garments (overalls, gloves, masks, goggles, etc.). The methods by which the rickettsia enter the human body are stated to be through (i) the skin, (ii) by inhalation, (iii) possibly through the conjunctivæ, and it is considered that the cases under review were infected by one or other of these methods. Once the typhus patients had been through the “human laundry” they became non-infective, and personnel nursing them were not at risk.

Conclusions to be drawn from experiences in the B.L.A. are as follows:—

(i) Three injections of typhus vaccine confer a high degree of immunity, and should typhus then be contracted it is rarely fatal. A booster dose should be given when indicated.

(ii) Personnel in close contact with “uncleansed” typhus patients should wear boots, overalls, gloves, masks (and perhaps goggles). This ensures that the very minimum of skin is exposed. They should be bathed, and dusted with anti-lice powder every day, and not be asked to work long hours in their hot anti-typhus clothing.

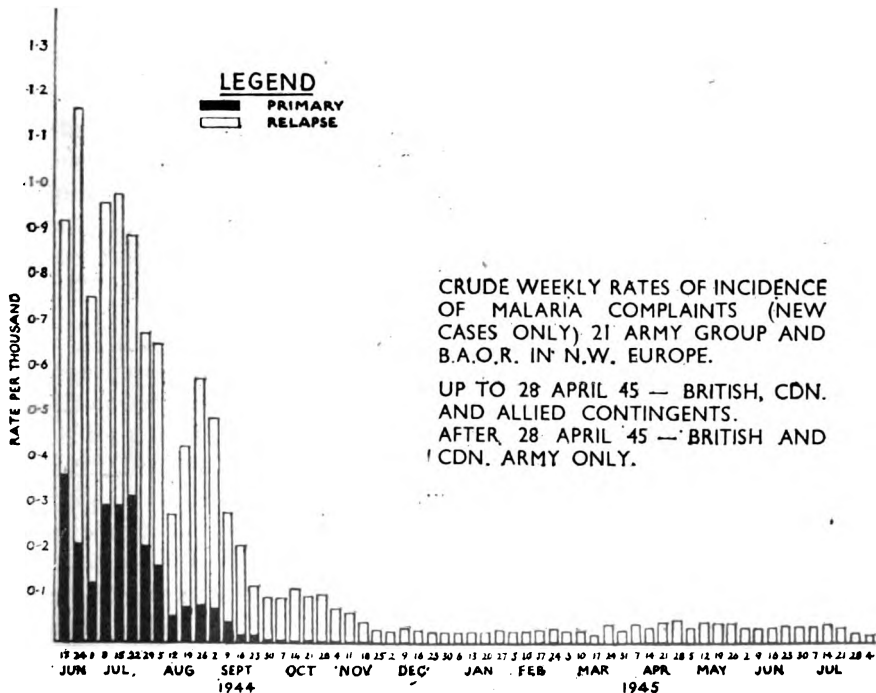
(iii) Personnel working amongst loused typhus patients should be dusted daily lest the odd louse get through “the laundry.” No other precautions appear to be necessary.

(iv) A.L. 63 powder (containing 5 per cent or 10 per cent D.D.T.) is a most effective agent for killing lice. Had it not been available in almost unlimited quantities for the Army, the D.P.s, and the ex-P.o.W.s, it is certain that typhus would have been almost as great a problem as it has been in the past. To be really effective in populations at risk a “lousing service” should be set up, with a maintenance service for the power-operated dust guns. Although D.D.T. was used on a large scale, no toxic effects were reported. It was chiefly in powder form, but fairly extensive use was made of D.D.T. in kerosene at the end of the campaign. Its use produced only occasional skin rashes

The incidence varied between 0.2 and 0.4 per 1,000 during the first five months. Thereafter it increased every week to a maximum of 1.4 per 1,000 in March, 1945, and continued at 0.8 to 1.1 for the rest of the campaign. It was treated effectively with benzyl benzoate; D.D.T. appeared to have no effect on it, and the incidence was a good index of the opportunities which the troops had for close contact with the civil population.

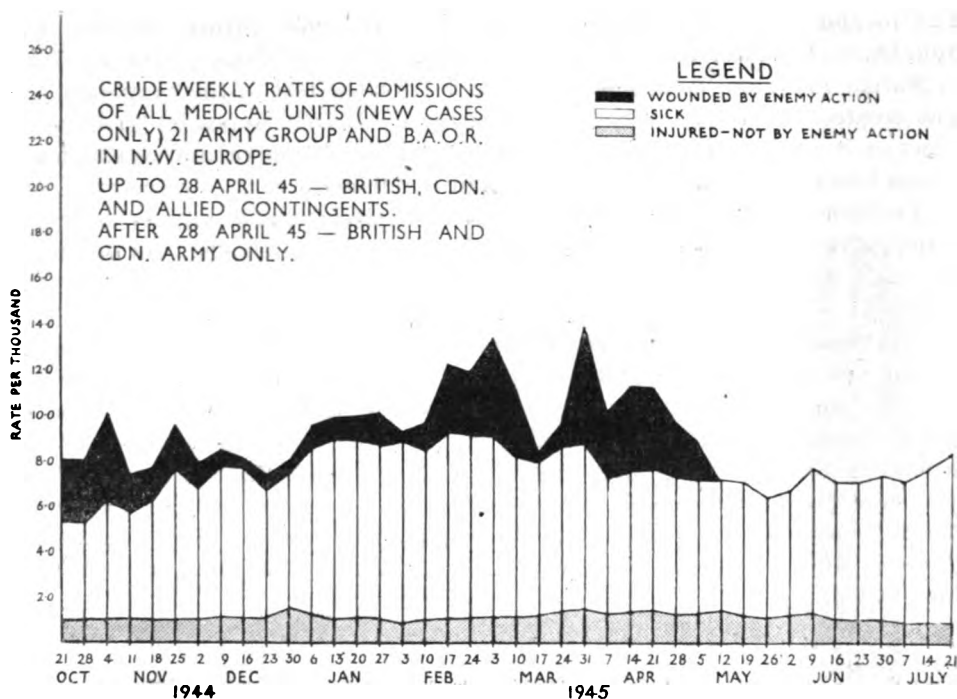
Pediculosis was almost entirely of the *Phthirus pubis* variety once the major part of the Army had left the Normandy battlefields. As might be expected its incidence curve followed the same line as those for V.D. and scabies.

(11) *Malaria*.—The highest rate was 1.8 per thousand and was recorded in June, 1944. This included both primary cases and relapses, and occurred in those soldiers who had previously served in the Mediterranean area or Middle East. During the succeeding three months the incidence declined rapidly to around 0.025 per thousand where it remained for the rest of the campaign. A very few cases were recorded where infection had been acquired in France and Belgium, but in view of the potential reservoir and the presence of mosquitoes capable of transmitting the malaria parasite, these were not unexpected.



(12) Comparison of Sickness and Injury Rates.

The most interesting feature of this table of hospital admissions is the relatively high sickness rate. During a long war in which every effort had been



made to produce and perfect weapons of destruction and mutilation, the incidence of deaths and wounds might have been expected to be far greater than the incidence of disease. This, in fact, was not the case. And it is even more remarkable when one considers that 21 Army Group was operating in a temperate climate.

Admissions to hospital for accidental injuries showed little variation throughout the campaign.

SUMMARY.

(1) The campaign in North-West Europe from the assault landings to the "cease fire" presented certain problems never previously experienced.

(2) The hygiene organization provided to deal with these problems has been explained, together with the methods adopted to solve them. Particular reference has been made to water supplies, food, personal hygiene and accommodation, as these factors are all important in the prevention of disease, and the limitation of its spread.

(3) Civilian features in form of refugees, displaced persons and ex-prisoners of war, have been discussed in some detail. Their disposal was a tremendous operation and had to be undertaken whilst the Army was still fighting. Had this operation not been successful a most dangerous state of affairs might have arisen in Europe.

(4) The incidence of the more important infectious and contagious diseases has been given and it is considered that the figures compare very favourably with those of other campaigns. Cases of pneumonia, influenza, meningitis,

and typhus, were negligible. Enteric could have been placed in the same category but for an isolated outbreak of seventy-nine cases. The very low incidence of louse infestation achieved by adequate bathing and laundry arrangements, and the use of A.L. 63 and impregnated shirts, provides a remarkable comparison with the 1914-18 war when 95 per cent of troops became infested after short periods in the trenches. The incidence of dysentery and venereal disease cannot be regarded as satisfactory, although the latter is to-day a moral rather than a medical problem. In considering the incidence of disease, and particularly the so-called "social diseases" (V.D., scabies and pediculosis) it must be remembered that France, Belgium and Holland had been occupied by the Germans since 1940. During the occupation standards of environmental hygiene had deteriorated, the incidence of disease had increased and food and drugs had become increasingly difficult to obtain. These factors prevailed in Germany, but not to the same extent. There were, however, additional risks in the "blitzed" towns, the "horror" camps, and the millions of displaced persons and prisoners of war.

CONCLUSION.

This article has been written by one who was a member of the British Second Army. In a war which extended from the English Channel to the Danish Border it is obviously impossible to obtain a complete picture of all the operations and the work carried out, and I should therefore like to thank all those members of the medical services—officers and other ranks—whose observations, conversations and reports, have helped in the preparation of what must be an inadequate record of their achievements.

I should also like to thank Major-General E. Phillips, the Director of Medical Services, for permission to forward this article and to use the records, etc., of the campaign at his Headquarters.

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HOSPITAL CONSTRUCTION.

BY

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THE affairs of man are never stationary. Alterations take place in all spheres of his activity. Some of these alterations can be truthfully labelled progress, others not. Whatever may be said about most of the activities of man it can be stated without question that the trend of medical science and the art which applies it is progressive; but can it be said with equal truth and emphasis that the architecture of the buildings in which the Art of Medicine is studied, taught and practised is progressive?

The present century has seen discoveries and inventions in medicine which are staggering in their magnitude and importance and which few medical men of the 1890s would have dared to foretell and fewer foreseen.

As a race we are devoted to tradition. In this respect nothing satisfies us more than to steep ourselves in the atmosphere of old buildings whose dumb walls have seen history made and through whose passages generations have passed and left something intangible but real as evidence of their passing. Those, like us, trod the familiar ways with aspirations and hopes and experienced high achievements and saddening failures. What Guy's man can gaze upon the ruins of the old Court House without a feeling of personal loss? What Thomas's man can pass the scarred and battered remnants of his hospital with indifference? We are sensitive to these things.

Now we are faced with great and sweeping changes in our medical world. The Medical Services of the country both civil and military are being re-organized on a scale gigantic in proportion and scope. Plans for the building of old hospitals and the construction of new are already in being or being prepared.

There is nothing new in the idea that hospitals should be housed only in non-permanent structures but it may be worth while to consider some of the factors which favour such an idea:—

General.—If developments in Medicine in all its branches are even as third as great in the next twelve years as they were in the last, then a hospital built to-day will be out of date in one or more aspects in twelve years' time if maximum efficiency is to be the criterion.

MEDICAL.

(a) *Investigations* fall into two main groups: (1) Those undertaken by General Duty Medical Officers; (2) those undertaken by Specialists.

Of the first group it has become apparent that newly qualified general duty

medical officers are sufficiently skilled on completion of their house appointments to undertake a very large number of investigations which, when they take up appointments in non-teaching hospitals, they are unable to undertake because of the lack of facilities. During the war medical experts were unanimous that in the management of dysentery cases a clinical side-room attached to the dysentery ward was an essential factor. It is the writer's firm opinion that this principle applies with equal force to the management of all major medical catastrophes. It is clear then, that every medical ward should be equipped with a side-room, adequate in size, containing all necessary apparatus. All too frequently no such facilities exist or, if they do, some form of improvisation (such as the conversion of a linen cupboard) has taken place. The tendency to-day is for the general duty officer to become a mere sorting machine. Too much material finds its way from the ward to the laboratory via this machine. Material is collected, a form is completed and both material and form disappear for an unpredictable period of time. The general duty officer merely awaits the result; the investigation in the meantime is carried out by an individual who has not the slightest personal interest in the case in question. The term "Penny-in-slot medicine" has been aptly applied to this state of affairs. It is difficult to imagine anything more detrimental to professional skill and, what is equally important, the interest which a doctor takes in his patient. I suggest, too, that much time would be saved and the risk of investigation records being lost minimized if the clinical side-room principle were exploited to full. But who can say that the clinical side-room of 1946 will be adequate in 1958?

Another feature of ward construction is that the examination of ambulatory cases has to be carried out in the ward because very few wards in any hospital have even a small consulting room attached. This necessitates the assembling of screens and apparatus; such measures at the best of times do not make for privacy and convenience. To take just two examples: The manipulation of a sphygmomanometer with the patient sitting or lying upon his bed, his bedside table deranged and the medical officer in a posture lacking in dignity and comfort; the checking of a patient's intrathoracic sounds when the ward is full of the buzz of conversation or the clatter of utensils. No medical ward is without its psychiatric patient but there is no convenient place where such a patient can be interviewed. The clinical side-room and the consulting room should adjoin one another and should be well away from the domain presided over by the Sister in charge of the ward and equally far away from the patient's recreation room if such an amenity exists. But who can say that such an arrangement will be desirable in 1958?

Of the second group of investigations, it may be justly claimed that there is even greater scope for speculation. Many pathological laboratories which exist to-day are inadequate and inconvenient from many points of view. Although clinical side-rooms would relieve laboratories of a considerable burden, the demands of new investigations and the means of carrying them out are constantly increasing. Future scientific discoveries will render the present-day laboratory obsolete in equipment, size and siting. Changes in this field are

resulting in pathologists, hæmatologists, clinical microscopists and their kin frequently putting up the cry, "Sorry, we can't do that . . . we haven't the facilities."

(b) *Treatment*.—Under this heading I only propose to touch on two points. The first is air conditioning. This has not been developed very far in this country. I hold that its possibilities are vast but development is hampered by the structure of our buildings. It is not difficult to foresee that the permanent buildings of 1946 will not be readily adaptable to the discoveries and advances of 1958 in this field alone. Not only can the gaseous content, temperature and humidity of the air be controlled but unpleasant (even noxious) fumes and foreign particles can be eliminated ; measures very necessary in most of our towns and cities. The day can be foreseen when the atmosphere of a ward can be charged at will with radiations of high therapeutic value. It would be more than regrettable if the planners of the future cursed the planners of to-day for having handed on buildings which could not be adapted to house their discoveries. The second point I want to raise is that of routine treatments and the segregation of various types of patients. An example best illustrates the point : a hospital has wards containing twenty-four beds each. Beds are required for twelve lung cases and twelve for alimentary cases. It is clear that it would be uneconomical for each type of case to be allotted a ward (24 beds) : so they are mixed in a single ward. Treatment for each type is largely routine but how greatly do the routines and general management differ. Steel frame sectional buildings would render the task of varying the capacity of wards a comparatively simple task.

SURGICAL.

The arguments I have used under the previous heading are all applicable under this. I would, however, add weight to the second point raised in the last paragraph : let us take as our example the division between "dirty" and "clean" surgical cases. It is never possible to assess the number of beds which will be required for the various main branches of surgery, orthopædics, E.N.T., eyes, plastic surgery and so on. It may be necessary to expand one or more departments simultaneously or to contract others. Sectional buildings will overcome these difficulties.

SPECIAL DEPARTMENTS.

To save space I will confine myself to three departments out of the many which could be cited. Recent years have seen enormous advances in psychiatry, physical medicine and radiology. Few hospitals can claim that architecture has kept pace with, or rather been in advance of, the demands in these three fields alone. It may be taken as certain that the hospital of 1946 will be inadequate in capacity or design to satisfy these demands in twelve years' time.

ADMINISTRATION.

The medical administrator is too often an overworked and harassed individual openly or covertly derided by his clinical colleagues. He has, in

most hospitals, a large staff to control and direct and duties of a highly specialized nature to perform which demand special qualities. Changes and advances in administration take place in this as in other branches of medicine. Again, for the sake of space, I will take but two examples. The designers of Queen Alexandra's Military Hospital did not foresee that a time would come when it would be highly desirable, if not essential, for an adequate central records room to be maintained in the hospital but nevertheless the need exists to-day and neither the staff nor the space exists to meet the demand. The dictaphone was unheard of a few years ago but one is shortly to be installed in Millbank and, if a success, it may be desirable to have more for the benefit of specialists and others. Space is likely to be the obstacle. In other words, hospitals, like banks and other complex commercial concerns, must be prepared to take machinery into consideration for administrative purposes and so effect an economic pruning of administrative staff. There are many other examples which could be stated and I cannot resist adding one more for good measure to the ones already mentioned. The war saw the development of the American idea of a central sterilization room and store for the provision of sets of instruments to wards. Every medical officer working in a hospital so equipped knows what a blessing this was. It reduced the items on permanent charge to the wards : there was no hectic borrowing at the last moment of syringes and the like between ward and ward ; the instruments were well cared for and ward staff were not taken off other duties to supervise the process of sterilization and the preparation of a trolley. The choice to-day is between improvisation and the denial of such a valuable measure. But will the provision of such a unit to-day, even if it were possible, be suitable in all respects in 1958 ? The role and purpose of a hospital may change from time to time ; this is particularly true of Service hospitals. Immediately the problem of improvising an obsolete building presents itself. The sectional steel frame building provides a ready solution. Changes in the type and number of staff must keep pace with changes of policy and hospitals are confronted either with out-of-date and inadequate quarters or buildings uneconomical to administer owing to too much space which cannot be readily adapted to current needs.

What I have said is by no means exhaustive but I trust that it is sufficient to stimulate physicians and surgeons to think upon and develop the theme.

ARCHITECTURE.

I have not lost sight of the fact that the examples of prefabricated buildings as seen to-day are hardly structures which appeal to the observer's sense of beauty. Before committing my thoughts to paper I had an informal conversation with an eminent architect who at the moment is actively engaged upon the reconstruction of one of London's most famous hospitals. He informed me that industrial research is developing successfully ideas which will result in rendering prefabricated structures pleasing to the eye both without and within. He also pointed out the chief obstacle to the construction of large prefabricated buildings : it is that at the present time they cannot be more than two stories high ; this means that any expansion involves an

increase of ground space. Horizontal expansion is easy but perpendicular expansion is in the realms of the future. He further pointed out that problems associated with the various branches of plumbing, lighting and heating are easily solved with even large prefabricated buildings. Plumbing units of varying types can be made to correspond with building units.

In the foregoing article I have attempted to build up an argument in favour of prefabricated hospitals but I am fully aware that many further arguments could be adduced. Equally I am aware that there are many arguments against the idea, but nobody can deny that the planners of to-day shoulder an enormous responsibility in the light of future advances in all branches of medical endeavour.

OPERATION—M.O.

BY

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[Received November 29, 1946.]

I USED to read with a great deal of interest and sympathy the correspondence columns of the medical journals in which disgruntled and anonymous doctors criticized in preciously worded phrases the apparent shortcomings of all the Service medical administrations. I say "with interest" because I, too, considered myself one of that large body of youngish doctors who were swept up on the rising tide of war, although admittedly never laying claims to a career blighted or a genius stifled by unpredictable exigencies. Now, with so many thwarted professional lives flaunted to the public gaze in what seems to be an ecstasy of intellectual masochism, I am forced to sit back and take stock of the "barren" years.

Discounting the general common factors of the inevitable discomforts, the threat of sudden oblivion or slow pain, and the desperate stoicism of long separations, I think that on the whole the balance was on the credit side. The near prospects of demobilization are always apt to colour with a roseate tinge of optimism the drab reality of the G.P. It seems to me that economic expediency has introduced into general practice a "catch-penny" pseudo-medicine, and that amongst the specialists there is a regrettable tendency towards professional intolerance and fratricidal skirmishing.

The good type of Service M.O. generally has a much clearer conception of the true function of medicine in the integration of human activities. His horizons are widened, and by constant liaison with men who are knowledgeably capable in their own spheres he finds that his own specialized experience is not a mysterious white magic but an asset of some importance, to be employed to the best advantage in the common good. The operative factors are contact and liaison, in which Service life is particularly rich and stimulating. Looking back over the war years I have not the slightest regret for what they unknowingly held, and this brief outline of my travels is offered not as some odyssey particularly rich in adventure, but as an illustration of what must have happened in many cases to a considerable number of G.D.O.s.

The receipt of an official envelope during an autumn morning of 1939 abruptly terminated my career as a locum-tenens and, incidentally, a difficult interview with a woman incapable of being convinced that the possession of an opulent fur coat and much material wealth did not necessarily confer upon her immunity from scabies. Embarrassingly uniform conscious and still the reluctant possessor of a civilian respirator in a cardboard box, I reported at Maidstone to a Field Ambulance which was suffering the growing pains of mobilization. After an orgy of equipping, training and speculation,

and a Dickensian Christmas spent in Dorset, the Division, after waiting vainly to hear its sailing date from Lord Haw-Haw, moved over to France very early in 1940.

With an A.D.M.S. who was an inexhaustible fount of energy and obsessed by the vision of R.M.O.s with iron nerves and steel bodies, rigorous training, frequent conferences on the field policy of the Medical Services and clinical meetings were the order of the day. Fortunately the regular battalion to which I had then been posted as R.M.O. was hygiene-minded. Much time and thought was given to the construction of cook-houses and latrines, which with rubber-rimmed, fly-proof lids, smoothly grained wood and cement food-rests reached such a high standard of privy perfection that they were opened ceremonially by a sanitarily disciplined and sociably inclined mayor.

But the pleasant teas and lectures in St. Pol and the browsings and comradely dinners in Bethune were dramatically brought to a close by the irresistible advance of the Wehrmacht into the Low Countries. In the ensuing weeks the life of the R.M.O. in the forward areas was anything but a sinecure. The unexpected mobility of the German war machine and the comparative inflexibility of our medical organization put a severe strain on all the pre-conceived ideas of lines of evacuation. My own impressions at that time were that at the R.A.P. one could effectively do nothing but a superior form of first-aid, and that in the face of a spate of severe battle casualties the M.O. was likely to be overwhelmed by conflicting urgencies. Often he was out of touch with his widely dispersed company stretcher bearers, and the tendency was for him to become a zonal surgical registrar, supervising the emergency treatment and the evacuation priorities of casualties sustained by all the units in his immediate vicinity. Confronted with a high and unanticipated incidence of battle-exhaustion amongst young troops brutally jerked into the ugliness of war, one began to appreciate the potential importance of front-line psychiatry.

However, it is certain that from the results of our inexperience many valuable lessons were learnt and, for those who came back from Dunkirk, there was at last a clear-cut picture of the capabilities and limitations of the R.M.O. in action. In the autumn of 1940 the main task of the Army at home was concerned with consolidation and cautious expansion. The medical officers of battalions entrusted with the defence of an unpleasantly long coast line were busily engaged in drafting elaborate schemes of evacuation from the interlocking pill-box defences. During this period the liaison with the E.M.S. hospital and the civilian auxiliary medical formations was especially fruitful.

Those were full days and not unpleasant. The menace of invasion, the titanic air battles over the coast-towns, and the inspiring deeds of Wavell's desert Army were an exciting background to a spurt of professional activity, in which the hazards of sudden blitzes, drifting beach-mines and "black-out" accidents made the M.O.s life a busy one. The Medical Services had been stimulated to an efflorescence of new ideas. War surgery and the mass psychology of large bodies of troops and civilians exposed to a long intense strain of aerial bombardment were all being studied with interest and profit.

It was found that the bigger hospitals were generous in the facilities they afforded the Service doctors of learning something of the rationale of improved surgical techniques and medical treatments.

As a result of first-hand observations and recommendations by R.A.M.C. personnel, establishments and equipment were undergoing drastic modifications in order to conform with the rapidly changing demands of war. All the Field Medical Units were emerging as highly mobile entities, completely independent and capable of splitting up again into self-sufficient, fully functioning sub-units. This was a time of unparalleled development and the Medical Services were keeping pace with the formation of special assault and airborne groups. No young and athletic M.O. could ever have complained of the lack of opportunity for the specialized exercise of his talents, and it is to the credit of the R.A.M.C. that its representatives were always found in the forefront of any new military venture.

Overseas, events were marching inexorably forward and Japan, destroying in a breath-taking advance every rule of die-hard military orthodoxy, was island-hopping to the borders of India. New expeditionary forces were being urgently raised and reinforced, and very soon in the company of many other G.D.O.s of a B.G.H. I found myself slipping away from England in a northern early morning mist.

As a prelude to the thunderous symphony that was to be played out in the jungles of Burma and Assam and on the plains of Mandalay, this voyage lacked nothing of drama or variety. There were the lush browns and greens of Freetown, the open-hearted generosity of Durban, the crystal clearness of tropical dawns, the lazy introspection of long afternoons on the sun-decks, the water ballets of dolphins and flying fish and, finally, the sudden bewildering contact with the hothouse turbulence of India.

Medical officers were needed, urgently and everywhere. All over India, hospitals, ill-equipped and under-staffed, were being hastily raised to accommodate the remnants of the decimated Army of Burma. Flung into the hurly-burly of administration as acting quartermaster to an I.G.H. one was forced to learn, in spite of the passive resistance of havildar clerks and the accepted routine of "passing the baby," something of the multiple processes that made up the substance of a man's hospital life between his admission and discharge. Although there was an abundance of clinical work, a patient to me was never a case of sand-fly fever or gastro-enteritis but so many seers of corn or an integer in a Walt Disney fantasy of permutations and combinations pirouetting crazily in a paper world of return, statistics and diet-sheets.

A peremptory order to rejoin my unit saved the last vestiges of my geniality and sent me hurriedly to Calcutta where the B.G.H. was concentrating and about to function. In those days of flux, the activities of a G.D.O. covered an amazingly wide field and were liable to send you trekking on a malarial survey to a jungle camp, to Assam for the unenviable command of a nightmarish improvised hospital train, to the stews and sinks of Entally as surgeon to a military riot squad, or over the Hump as a medical courier to Chungking. But these were only the highlights in a hospital routine. We learnt something

of the intricacies of malaria, of the realities of typhus and kala-azar, and of the impact of malnutrition and anxiety upon bodies already weakened by sub-clinical tropical disease.

Calcutta itself was an uneasy compromise of diametrically opposed civilizations. There were air-conditioned cinemas and leprous beggars, wedding cake villas and open drains, gargantuan steaks and chips in the restaurants and emaciated corpses in the gutters. A nuisance raid in which a few 50 pounders were haphazardly scattered over the city ushered in the Christmas of 1942, and caused the *Statesman* to proclaim the next day in a squeak of bravado that "Calcutta can take it." Those who had experienced the terror bombings in England were left in some doubt as to what exactly Calcutta could take except a toll of one's pocket-book. There was a general exodus, and for days the barbed-wire approaches to the railway stations were besieged by a mob in the grip of an unreasoning instinct to escape anywhere at any cost away from the immediate threat.

Meanwhile the Eastern Army was concentrating its troops on the marches of India, and, in the New Year, the advance was signalled in the Arakan. The brigades moved forward on a narrow front, deployed, faltered and were bogged down in a morass of operational snags. Not the least amongst these was the high casualty rate from disease which enfeebled and drained the effective strength of the attacking force. The Medical Services were almost swamped by the flood of sick, and were handicapped by the natural disadvantages of the stretched-out, vulnerable lines of evacuation.

The call went out for medical reinforcements and, being a member of the hospital "Flying Squad," and in addition more than normally subject to the caprices of an invisible C.O., I was transferred to Chittagong for onward transmission—an ominous sounding proviso. At Chittagong—a port almost emptied of civilians by the whisper of war—we were fortunate enough to embark for the next stage of the journey upon the Hospital Transport "Wu Suey." A craft of long and varied service in the Chinese rivers and skippered by a glassy-eyed, weather-salted character straight out of the pages of Conrad, she was in spite of her doubtful seaworthiness a delightfully clean and pleasing sight and our last link with the refinements of civilization. For three days as we wallowed our way down the coast to Maungdaw we ate and slept to repletion and strolled the decks at night in the unfamiliar glare of the flood-lights that picked out the Red Crosses, and gave point to the Old Man's indignant stories of being deliberately machined-gunned by Zeros whilst his ship was lying peacefully tied up in Chittagong harbour.

At Maungdaw we were met by casualty-laden rafts, and went ashore to the dull thuds of artillery over the near-by range. That was Thursday. On Friday afternoon the Transit Camp was badly strafed and for three days we worked in shifts to patch up the military and civilian victims of an indiscriminate bombing. Sleep became a luxury, and for weeks the daily routine consisted of camp-bed, mess-tent, operating theatre and wards, and so on in cyclical time where our world was bounded by Buthiagung, Indin and Foul

Point, and the most valuable gifts we had to appease the petulant angels of death were pentothal, chloroform and quinine.

The most potent single enemy was the mosquito, and as the sick poured into the C.C.S. they overflowed from the bamboo beds on to the mud floors and from the floors out on to the dried grass surrounding the maidan. One evening when the sun went down in a riot of Gauguinesque colouring the hospital was holding, in spite of its ceiling of 200 beds, 1,400 very sick patients. Guilty as we may have been of the sententious verdict of "clinical indiscipline" there is certainly no doubt that the immediate and unhesitating resort to intravenous quinine in those patients almost *in extremis* and suffering from coma and marked hyperpyrexia proved a dramatic and life-saving measure.

The myth of the ubiquitous Japanese conqueror was then still persistent and growing on the ever-present apprehensions of infiltration and isolation. It was in this troubled atmosphere that the "Battle of Maungdaw" took place and gave to one memorable night the appearance of a scene out of Dante's "Inferno." For hours thousands of multichromatic rounds of every description were projected monotonously and almost casually at an invisible and non-existent enemy. We had had our excitement before when a rogue elephant stampeded the forward observation posts or when a courteous Japanese pilot had dropped a warning message into the middle of the compound, but this was an infinitely more serious menace to our tranquillity of mind. Any evacuation of a dangerously expanded C.C.S. was impracticable and impossible in view of our chaotic state of knowledge of current events. The highlights of a crazy interlude were the misfortunes of the Consulting Surgeon to the Eastern Army whose visit had coincided with the outbreak of pseudo-hostilities. Crouching in a slit trench in his precipitous exit from the Mess he had only just missed being drenched by the nervous urinations of an over-tense medical orderly, and in a rapid dash for his steel helmet he had become the focus of streams of tracer bullets which pursued him relentlessly, but happily left him unscathed and puzzled as to what advantage his sudden demise might have for the enemy within the gates.

Within the next few days to everybody's relief we pulled out of Maungdaw and made our way back in easy stages from Tambru Ghat to Cox's Bazaar and thence to Chittagong which was alive with military activity and held for us all the attraction of a great metropolis. The memories of those times are as bright and clear as a string of pearls. I can remember swimming from incomparable beaches along the Arakan coast, doing lumbar punctures by faith and the light of a hurricane lamp, rambling across deserted paddy fields in a cerulean twilight, and eating inspiringly appetizing chicken pillau to the accompaniment of mountain guns. Then, wonderfully, came the recall to Calcutta to become a trainee in psychiatry, and I left full of high hopes the tiny bungalow on the crest of a hill where I had commanded in solitary splendour the varied fortunes of a Mixed Malaria Convalescent Camp.

Calcutta in the late summer of 1943 was very much like the auditorium of a theatre in which an old and tried play was to be successfully revived. In the Middle East a new star, Montgomery, had appeared swiftly and brilliantly

on the military horizon signalling the destruction of the Afrika Korps, and the repercussions were felt in Bengal where optimism amongst the official spokesmen was reaching a fresh zenith, even though the submerged tenth of the civilian population were dying almost blatantly of starvation in the sewer-blocked avenues.

During the day in the mental wing of the hospital which had once been a convent school, we learnt to unravel the tangled skeins of worry and repression which made up the complicated syndromes of anxiety neurosis, and tried to penetrate the veils of inarticulate misery with which the acute depressives enshrouded their illogical agonies of the spirit. The golden evenings were spent at the swimming club, riding at Tolly-gunge, or wandering round the vast caravanseraï of the city which now presented the appearance of a seething, multi-racial armed camp. But behind the scenes my personal destinies were being drastically rearranged.

Some months before when the dawn miasmas, the prickly heat and the aggregate annoyances of flies and mosquitoes had undermined my jungle acclimatization, I had wilfully violated the oldest and most sacred of unwritten Army laws by volunteering—this time for the paratroop medical service, which was then nothing but an ambitious scheme on paper. Now out of the whitewashed office fastnesses of New Delhi came the urgent priority call to fulfil that pledge. Much to the horrified amazement of my colleagues who assumed that I had been affected by too close a contact with psychotics, I went off to the preliminary interview, was carefully examined and was posted off to the northern foothills where the Indian Parachute Brigade was engrossed in its independent and exalted ways.

Unscrupulously circumventing the cholera quarantine which was temporarily isolating the Brigade Camp from the pleasures of Rawalpindi I reported to Field Ambulance H.Q., and immediately felt like some world-weary explorer who had stumbled upon a perennially young Shangri-La. Having already had the privilege of serving with some fine units, I felt that I was more than fortunate in being accepted into a specialized formation which was ably commanded, well officered and superbly manned by the pick of Indian and Gurkha battalions. Like everyone else I was at once infected by the aggressive youth, the resolute optimism and the unshakable belief in its future which were the keynotes of the Brigade. Reverting occasionally and rather shamefacedly to my psycho-analytical hankerings I used to question the younger officers as to whether they had ever considered their motives and the eventual outcome of their volunteering for parachutist duties. Almost all of them replied, quite honestly and sincerely I think, that in the Brigade they had found their true metier and that provided they carried out their appointed missions with courage, determination and a reasonable degree of success they would be well content and not fruitlessly question an imponderable destiny—an oblique rebuke to my curiosity and one which was accepted and well deserved.

Training was at once rigorous and invigorating. We used to rise at first light, lope three miles across weather-eroded, dusty country, swim in the icy,

swiftly flowing waters of the river Haare and trot back to cold showers, immense breakfasts and the pitiless mid-morning sun. There were endless hours of rolling and tumbling, and jumping in the approved manner from low bridges on to the sandy beds of dried-up stream, games to quicken the senses, long evenings of volley-ball, shikari in the thick scrub which covered the rocky foothills, and long forced marches by night when the stars were bright and hard, and the stony bare slopes held for the unwary a thousand pitfalls. When trying to reply to my cynical friends as to exactly what advantages I had accrued from all this I am hard put to it to find a factual answer, except that never before had I experienced a body which moved easily and faultlessly to my slightest will, nor ever before felt the deep tranquillity of sustained fatigue as one climbed to the crest of the right hill and rested replete with the innate spreading satisfaction of warm tea against a sheltered boulder, sweat drying cool on the brow and cigarette smouldering friendlily in the glimmer of an approaching dawn.

Over all this hung the imminence of the First Jump, and almost before we had the opportunity to realize it the testing time was upon us. and my section and I were sent down to Chaklala to overcome the preliminary hurdles of Ground Training and Air Experience. So much that is trite has already been written upon the subjective sensations of parachuting that one is loath to comment upon them any further, but it is sufficient to say that the experience of jumping voluntarily is such an intense and personal one that any effort to convey the impression it produces to a non-jumper is necessarily foredoomed to failure. To the committed parachutist the act of controlled jumping is both a challenge and a consummation of the will.

Some weeks later after we had qualified and were doing operation training I used to stand, hooked-up and not unconcerned, at the Dakota jumping door, and, rubber-helmeted and fantastically bedecked with paratroop impedimenta, let my mind wander in the brief moments before the action order back to the archaic pre-war days. The contrast was as utterly incongruous and hopelessly irreconcilable as the sober pin-striped suit and black Homberg that one would have worn on rounds on just such another warm and sunny afternoon.

It was becoming increasingly obvious that the foundations of victory in Burma could only be laid in the air, and the characteristic of the Airborne Brigade was a persistent craving for action. It was not the desire for desperate, quixotic heroics but the slightly tense keenness of a finely trained thoroughbred to demonstrate the height of its power. And bazaar rumours were not slow in forthcoming. Time and time again we stood to for twenty-four hours and packed and repacked our kits stripped of everything but the barest essentials. Finally in the first quarter of 1944 we moved up to Northern Burma on the last stages of jungle training in preparation for our tactical role, a super-mobile reconnaissance and battle formation auxiliary to the forces of General Wingate.

Unexpectedly we did come to grips with the enemy. To counter his lightning thrust across the Chindwin, two-thirds of the Brigade went in as ground

troops at a moment's notice, vastly outnumbered, at a tactical disadvantage and committed to what at best could only be a delaying action. Withheld for some months for very valid reasons of security, the story of the ensuing Battle of Sangshak added lustre to the slowly unfolding epic of arms of the Fourteenth Army. As in every other battle that marked this critical stage of our military affairs on this front, there were the incidents of almost superhuman gallantry, the stubborn fight against overwhelming and ruthless fanaticism, and the tenacity which compelled men, who had lost nearly everything but their courage, to fight on. After what appeared to the survivors to be an eternity of days and nights of sense-numbing warfare, the Brigade, shepherding its wounded, assaulted and pierced the encircling Japanese lines and withdrew over the hills, of which every path and nullah held the menace of ambush and death, to the uneasy sanctuary of Imphal. At Imphal, which was destined to be the burial ground of Japanese Imperial aspirations to India, the battle-worn battalions of the Parachute Regiment were farmed out to other formations. The Surgical Team, of which I was the anæsthetist, was attached to an A.D.S. at Bishenpur, the southernmost strong-point of the Imphal defences.

Tearing a large cavern out of the slopes of Bishenpur Hill we began to live like troglodytes, eating, sleeping and working in what was fundamentally a commodious operating dug-out. Time once again lost its significance. During the day we came pallidly up into the fresh air, read mail, cleaned out the dug-outs, evacuated patients, or just rested passively on the banked-up sandbags, which as the weeks went by began to split and sprout out small green fronds of jungle vegetation. The daily routine was stably built up round tinned beans, corned beef, "V" cigarettes and tea, and marked at regular intervals by the bark of ranging enemy infantry guns, the chatter of automatic weapons and the crack of mortars from the forward outposts. At times as we spooned sulphanilamide powder into neatly trimmed-up wounds we heard rumours of a new wonder drug called penicillin and, remarking casually that the name took us back nostalgically to the far-off days of premedical botany, dismissed the subject and carried on with the next patient and the next transfusion.

And then one day on the airstrip at Imphal we were told that "D" Day had actually happened and, for a moment, the curtain that covered the immense conflict in Europe was lifted and our thoughts winged over space and time to Dunkirk and to this the day of the final reckoning. But somehow we were curiously undisturbed and saw the Invasion only in terms of what it could immediately mean to us. In morale and in the promise for the future it meant a great deal, for soon the Japanese, beaten and starving, were hunted into the hills, and the Indian and British Corps were moving southward through the valleys, over the long winding roads in the torrential rains, over the passes to the Chindwin, over the Irrawaddy, and on to the final magnificently successful assault on Mandalay.

As much as I would have liked to have been in a triumphant advance, a privilege still as yet unexperienced, this was denied to me for, as the wheels began once again to turn, I was pulled out of my unit to take over the newly created Medical Wing of the Airborne Forces Research Centre. There were

many things to think about as the Imphal airstrip disappeared beneath the tail plane of the Dakota taking me back to India, and I was lost in retrospect until we entered the humid blanket of the Ganges Delta and, banking round the balloon barrage and the glinting tracery of Howrah Bridge, grounded on the busy runways of Dum-Dum airport.

This was Calcutta again, but since my last visit it has really become the hub of the military world and was once more on the crest of a rising wave of optimism. For the first time in the mixed fortunes of the global war the tide had turned everywhere in favour of the Allies, and instead of impeccable drill and escapism one saw threadbare jungle-green and sensed a justifiable feeling of accomplishment.

There was no time, however, for leisured and philosophic reflection because at Chaklala, my new H.Q., the future organization of the advancing armies was in the melting pot, and we were trying to cope with the multiplicity of problems that the latest and most important factor of air transportation had created. We were now taking for granted in the pattern of warfare decisive changes that only a short time before would have been considered as daring and improbable innovations. It was only a few weeks previously that I had seen one of my sections parachute down into No Man's Land south of Mogaung in order to set up a Reception Station in front of an advancing Chindit column—a far cry from the old order of casualty collection and evacuation. The new job was fascinating in its many aspects and in that it gave me a free hand and illimitable opportunity of liaison with the R.A.F. and all other branches of the Service. With a task force of one store havildar and two intelligent sepoys we set about the splitting up of medical unit W.E.s into practicable air-portable loads, the adaptation of special medical equipment to the needs of the parachutist, and the possibilities of dropping heavy surgical equipment in the standard parachute containers. In addition we were working on improvised comprehensive medical packs, and it was part of my lesser desirable duties on the experimental side to jump with these and other gadgets such as collapsible airborne stretchers and operating tables. The air evacuation of casualties and air-planning were obviously important problems, and from the purely medical viewpoint we tackled, with equanimity and impartiality, parachute injuries, air-sickness, physical and mental stress, night vision and, most important of all at that juncture, paratroop selection. These were only the everyday needs. We were asked at odd intervals to investigate the possibility of dropping live mules by parachute, to drop Red Cross bundles into P.o.W. camps, to put stretcher fitments into gliders, to transport disinfestors, refrigerators for blood and even a complete prefabricated hospital by air, and as a final request to see whether volatile anæsthetics could be safely carried at the ceiling altitude of Transport Command aircraft. As the converging forces harried the retreating Japanese and we regained old ground and invaded fresh territory the prevention of tropical disease became increasingly important, and we had to consider the probabilities of spraying potential campaigning country with D.D.T. from the air. The days flew past and I could hardly find the time to carry out the most interesting of my functions, that of correlating

from all over the world the relevant medical information in any way connected with airborne tactics and strategy.

Living as I did, constantly, in the informal Mess of an operational Wing, I could not help but become acutely air-minded, and at the same time develop a strong admiration for the air-crew and glider-pilots with whom I came daily in contact. Devoid of any brash egotism, veterans of the Battle of Britain, North Africa and Italy, they carried out their monotonous duties with a calm efficiency and quiet courage which was later fully demonstrated in their critical supply dropping missions to formations isolated in Central Burma. The inter-Service cameraderie was always most impressive and the atmosphere of friendliness and co-operation that existed between air-crews, parachute instructors and airborne personnel was engendered by an intimate knowledge of each other's problems and reliability.

With an office on the verge of the runway, an Experimental Flight at our disposal, and the whole of S.E.A.C. as a ready-made laboratory, it was natural that air travel should constitute a large part of the daily schedule. There seemed to be nothing strange in flying at the instance of a laconic telephone message to check up on some technical detail of air evacuation at Myitkyina, to Comilla for a conference on medical staff-loading tables, or to South Arakan for a demonstration of mass supply dropping. It was on the return from one of these frequent expeditions that we landed at Agra, swam on a warm, jasmine-scented night in a floodlit pool, and took off the next morning by banking round the white domes of the Taj Mahal, even more lovely by dawn, for the benefit of three pleasant, wide-eyed American nurses whom we were helping to transport to Kashmir. The flight was monotonous, the seats were hard, and all being tired the conversation languished. Suddenly the wireless operator burst in waving a message form and announced almost unintelligibly in his excitement that Germany had submitted to unconditional surrender. I think that we all went a little mad, drank canned beer, munched chocolate and, exchanging parts of each other's uniforms, jitterbugged up and down the main cabin.

But the celebrations, hectic as they were, were short-lived for now the eyes of the world were turning to Asia, where with the stage crammed with troops, machines and engines of destruction, the curtain was going up on a clamorous, dramatic finale. The pace was perceptibly quickening, and the weeks were taken up with experimenting, jumping, writing, flying and interviewing volunteers for parachute duties from the training divisions. I watched the airborne operation on Elephant Point preliminary to the capture of Rangoon, and saw with proprietary interest the Parachute Brigade expand to a magnificent division of high trained assault troops.

And then, suddenly, a mushroom-shaped cloud of earth erupted and billowed on Hiroshima and the atom bomb had arrived to shake the foundations of military science and divert the future trends of human thought. The rapid capitulation of Japan after days of indecision and rumour was in the nature of an anti-climax, for the war machine, geared to its highest potential, raced without any incentive heedlessly on. With no immediate objectives in sight

there was created a vague sense of frustration and disappointment. The Canadian pilot who brought me back from Colombo unconsciously expressed the hidden thoughts of many others when he said on hearing the news of the end of the war which had gone on for so long that it had become a habit: "Well, fellow, I suppose I had better start looking for my place in the bread line."

Being very near my date for repatriation I had hoped to taper off the work in the last few weeks and do so many of the things that I had reserved for the leisure days. But once again I found that I had not counted on the vagaries of medical postings, and, instead of going home, embarked at Bombay with a Brigade of a British Airborne Division on its way to Malaya. Browsing in deck chairs, listening to stories of Arnhem, Normandy and the Rhine, working in the ship's hospital, the days went pleasantly by until we slipped into the Malacca Straits and the British paratroops prepared for their assault landing. This was mounted and unopposed, but unnecessarily arduous in view of the fact that the sealed plans for the attack, drawn up some time previously, had been rendered obsolete by the rapid change in the general situation, and had never been rescinded.

However, the men re-embarked and a few days later landed ceremonially at Singapore. Here where English tobacco was the "Open Sesame" to the miraculously restored riches of the East, we wandered at will and idled in the resurrected Chinese pleasure grounds. And it was also here that I contacted the immensely enthusiastic and efficient A.D.M.S. of the R.A.P.W.I. organization and watched him as, from the nerve centre of his network, built up from the minimum amount of facilities, he despatched doctors, medical orderlies and essential stores by aircraft and parachute to far-flung points in Malaya, Sumatra and Java. This was service, unstintingly given and of the highest possible value. And it was finally here that I saw something of the substance of victory, not, as I had imagined it, in the welcoming arms, the cheering crowds, the brass bands, the white-blanced belts and the gleaming bayonets, but in the quiet, inward exultation of those prisoners who, liberated from the lingering death of jungle railways and camps, were slowly returning to a new realization of life.

Meandering leisurely back we collected ex-prisoners and civilian internees from Hong Kong and Rangoon, W.R.N.S. from Colombo, and repatriates from India. Work in medicine and surgery was abundant, and there were always emergencies of varying degrees of magnitude. One unforgettable day we were asked for an opinion by the ship's surgeon as to the possibility of lymphogranuloma inguinale or plague in a lascar seaman with a suspicious fluctuating swelling in his groin. The correct diagnosis was of supreme importance as the presence of plague on board a ship crowded with men whose resistance to disease had been lowered by years of privation might have been a catastrophe. Microscopic examination of a smear was indeterminate, but fortunately it was decided after a long conference that the case was not one of plague, and much relieved we proceeded on our way. The ex-prisoners, sometimes garrulous but mostly silently introspective, watched every movement

of the children at play, made them toys, speculated on the immediate future, and listened avidly to news of a world from which they had so long been separated.

Suez, the Mediterranean and Gibraltar all lay behind us and at long last we steamed up Southampton Water past Netley and docked in the pouring rain. A band played, a General made an inaudible speech and junior officers and orderlies became fussily important. People waved from the quayside, and one Q.A. who had been the essence of encouragement and kindness throughout the trip pointed to a rotund, wildly excited little figure gesticulating from the top of the Customs House, and crying "There's my mother." burst into tears. It was a pathetically brave show of welcome, and we studiously avoided each other's eyes or else grinned forcedly and too broadly like comic figures in a puppet show. But as we filed impatiently down the gangway, the tension dissipated in a surge of contentment for this was Blighty, the end of the line, and we were home.

Since then the affairs of the Army have taken me through the devastations of Germany, where the universal plaint "*Alles ist kaput*" seems to sum up the destiny of all would-be despots, and to the ravished and battle-debris strewn land of France. I have eaten bouillabaisse in the Old Port of Marseille, seen the sunken fleet at Toulon, and swum deep down into the clear blue waters of the rocky caverns off Porquerolles. And during those years I have seen much, for all of us have known the stark nakedness of fear and have looked up to that indomitable courage which rises strong and clear above the infirmities of the flesh.

Whatever may have been my original intentions in writing this personal survey, I now feel on reconsideration that a tendency towards Service medicine needs no apologia. The significance of a Service is far greater than the sum of the capabilities of its members, for it is constantly enriched by tradition and practice. Although the roads of the passing days may lead anywhere into the future I, for one, have no regrets for remaining in a Corps, whose past and present have emblazoned the records of service and devotion to humanity.

I am indebted to Lieut.-Colonel J. McN. Lockie, A.D.M.S., B.A.S. (France), for permission to submit this article for publication, and to all my friends and acquaintances who have contributed to a valued store of memories.

Clinical and Other Notes.

AMCEBOMA OR CARCINOMA OF THE RECTUM ?

BY

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RECENT literature has discussed the surgical complications of amœbic dysentery including amœboma (Cropper, Smythe and James). This serves to remind us that we must keep amœbic dysentery in our surgical differential diagnosis. But at the same time we must not hesitate where the physical signs are so clear-cut that another pathology is indicated. This pre-occupation with amœbic dysentery caused a physician and a surgeon to hedge in a patient suffering from a frank carcinoma of the rectum.

James reported that in a series of a thousand cases of amœbic dysentery six cases of adenocarcinoma of the colon (two of which were within reach of the examining finger) were treated as dysentery.

As a routine in this hospital all suspect dysenteries are examined with the sigmoidoscope. In one patient at this examination the attending physician considered he saw either a carcinoma or an amœboma. This examination was repeated and a surgeon agreed but considered that amœboma was more likely because the patient had served abroad where he had had occasional bouts of diarrhoea and because his age was 43.

Before any further investigations were undertaken I asked to see the patient. He stated that twelve months before admission he had had injections for piles. He had not been hospitalized previously for dysentery. His present complaint was looseness of the bowels, the motions being watery, loose and containing blood; previously he had had one firm motion per day. There was no loss of weight. The only physical signs were in the rectum where on digital examination a typically craggy hard tumour was felt in the lateral rectal wall. Its lower edge was raised but the finger could not reach the upper limit. It was not fixed. The prostate and vesicles were normal.

Sigmoidoscopic examination was suggestive of a malignant ulcer whose edges were raised and everted and whose centre was ulcerated, friable and bleeding. It was situated $3\frac{1}{2}$ in. from the anus. The appearances were that of a carcinoma of the rectum and of nothing else. A piece was removed for section and the patient transferred to the Surgical side where his colon was prepared for operation.

Biopsy showed an adenocarcinoma. Perineo-abdominal excision of the rectum was performed under spinal nupercaine plus cyclopropane and oxygen (Major Miss Watson, D.A., R.A.M.C.).



FIG. 1.

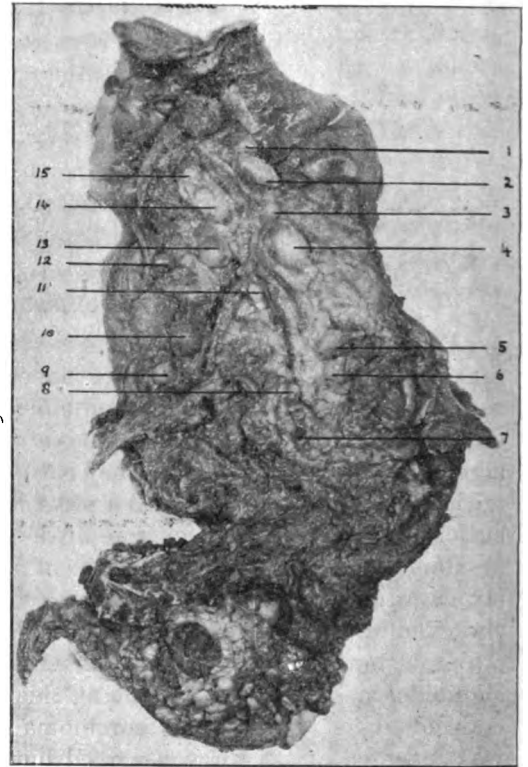


FIG. 2.

The specimen was sent to the surgical department of the Royal Army Medical College who kindly supplied the photographs. In fig. 1 the specimen is laid open to show the malignant ulcer. In fig. 2 the excised rectum and anal canal is viewed from behind to show the dissected vascular pedicle with the associated pararectal and superior hæmorrhoidal lymph glands which have been numbered.

Major H. Spencer, R.A.M.C., of the pathological department of the college reported microscopically that "the rectal growth itself is a tubulo adenocarcinoma. There does not appear to be any deep penetration of the muscular coat. Lymphatic glands 1, 2, 6, 7 and 10 are all free of carcinomatous cells but show a good deal of chronic sinus catarrhal change indicative of chronic inflammatory changes. The growth is classified as a Broder type 2." According to Dukes classification it belongs to group A, 83.9 per cent of which have a five-year survival rate after combined excision of the rectum.

When the convalescence was complete the patient was boarded out of the Army and referred to the rectal clinic of a civil hospital for follow-up purposes.

I have to thank Colonel A. R. Oram, *O.B.E.*, *M.C.*, Officer Commanding this hospital for permission to forward this case.

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A SURGICAL TEAM IN THE WESTERN DESERT

(Some extracts from the Diary of their Anæsthetist, as written in the months of July and August, 1942)

BY

Major MERVYN DENTON

Royal Army Medical Corps.

July 3rd : After a very hazardous journey on a moonless night made easy by surrounding searchlights we arrived in our three-ton lorry at Alamein station and got further directions. The station was patrolled by South Africans, wearing Australian hats. They informed us that the whole area was heavily mined and that bombs had fallen near-by the night before—our impression was that we stood in rather an unhealthy spot. A D.R. piloted us over some six miles of rough tracks and we finally reached our destination about 0300 hours on the 4th. Unrolling our valises beside the lorry we slept somewhat fitfully being awakened by flies and the constant drone of our own aircraft at daybreak.

July 4th : Dawn found us at Bergel Arab in a flat plain between two escarpments about six miles apart. Vehicles were widely dispersed around us over an area about one mile square. We next found the cookhouse and, after emptying the contents of our billy-cans, went on a "scrounging expedition." By the end of the day we had begged, borrowed or "obtained" one large tent with a lorry for a ward; an operation tent (E.P.I.) and two large double-ridged tents about 14 ft. square. One we used as a sterilizing tent, attached to the end of the operating theatre, and the other we erected about 50 yards away for our own sleeping quarters. By 1630 hours we had started working and continued until about midnight when we ended with a somewhat dramatic head injury. Superficially there was a slight flesh wound, no bony injury was found; there was some extradural hæmorrhage. The skull was trephined and the dura found to be blue and bulging. At this stage the patient ceased breathing and was pulseless. The dura was then rapidly incised and blood clot under considerable pressure came out. Artificial respiration stimulated breathing, colour returned and a good pulse was felt.

Deep in the brain tissue arterial breathing was noticed. It was impossible to check this and the brain was then packed with gauze. The patient lived for three hours.

July 5th : We started about 0930 hours and put through a number of bad tank burns ; the majority were resuscitated and sent on to the base. We continued through the day to about 1700 hours.

Everywhere we found the men bronzed and looking very fit and everywhere was the same cheerful grousing but it was a healthy, robust type of grousing. At 2100 hours we sat down outside a lorry to hear the news. There was some music played by the band of the Grenadier Guards in Hyde Park. "to a crowd of people representing almost every unit in the Services." The news—rather guarded and uninformative—did not depress us.

July 6th : Rose at 0700 hours—porridge, sausages and fried bread—the team in good spirits. Life is very simple—we feed with the troops, sitting on the ground round the kitchen. Our living standards are those of the men, i.e. we queue up for our food and cup of tea—it is a democratic Army. Spent a quiet morning cleaning the theatre. We saw the graves of some seventeen men, recently buried. I suppose the sand will soon obliterate these flimsy wooden crosses, hurriedly knocked up from wooden petrol cases. In the midst of the British graves was—"Unknown P.O.W.—Afrika Corps."

At 1600 hours the familiar convoy of ambulances came over the top of the ridge and, despite the lateness of the hour, our day's work commenced. We finished at 0445 hours the next morning.

July 7th : By 1000 hours casualties only a few hours old began to arrive. At 1700 hours a few more cases arrived, among them another German—his entry wound just above his pubis involving the bladder and peritoneum with a shattering exit wound in the sacral region. We worked on him an hour and a half and, contrary to expectation, heard that he had lived. On the tenth day he wrote to his mother : "I was wounded in the last battle but it was good to hear the screams of the wounded and dying British soldiers." He had a cigarette case with the name and address of someone living in England, a British shirt and British ration matches and cigarettes, perhaps some of the booty from Tobruk. Most German wounded came in with wounds several days old and badly infected.

July 8th : Worked from 1400 hours until about 2300 hours. Books and other amenities came to hand which should make life a bit easier.

July 9th : A quiet day.

July 10th : I went to a near-by base to collect stores and equipment. Tried to sleep in the back of the ambulance coming back and was glad I was not a wounded casualty—it was mighty rough travelling. Arrived back about 1600 hours. Our team was busy and I joined them and worked through to about midnight.

July 11th : The busiest day so far. It seems our offensive has begun.

July 12th : In the evening I lost a patient on the table (pentothal 0.5 gr., followed by a little chloroform 1, ether 2, drops). He had been badly shocked but was well resuscitated on arrival in the theatre. This is the third case of

this type I have had in the last week. I consider the rapid resuscitation of shocked patients gives the anaesthetist a sense of false security. The condition of these patients renders them very prone to complete collapse after a comparatively slight stimulus. They have, therefore, very little resistance to anaesthetics. Death is dramatic; at one moment the pulse is good, then there is a short pause in the breathing and the heart stops beating in a matter of seconds. The danger would appear to lie in attempting to work on patients who have been recently and rapidly resuscitated. I now think that, wherever possible, a patient should not be operated on until his blood-pressure has been well maintained for a minimum of at least six hours. Of course, this is often impracticable for, unless surgical intervention is risked the patient will assuredly die.

Every afternoon now the sand blows up; there is a continued gritty taste in the mouth; everything is covered with a fine irritating dust. Getting into blankets only sets up a shower of dust and, in the end, we do not even attempt to combat it. We are asleep as soon as we lie down and remain asleep until the distant shout of the cook's, "Come and get it," reminds us that another day has begun and that breakfast is ready and waiting for us.

July 13th : An early start. We had lost two patients overnight, both with multiple wounds quite beyond the power of the body to supervise. Yet, sometimes, we are surprised by those who continue to live after the most shattering injuries. Our work seems so unproductive, trying to patch up broken bodies with the knowledge that, however hard you work, you cannot affect or stop that convoy of ambulances that crawls down over the top of the hill. In the end we become almost mechanical. How casually we say: "Sorry, old boy; I'm afraid this leg will have to come off," and yet to the patient this is a life-long catastrophe.

Aircraft very active to-day and fighters by the dozen flew to and fro almost playfully looking for trouble. The distant artillery barrage seems very heavy.

July 14th : Visited a near-by hospital for lunch and a bathe, arrived back at 1700 hours and worked from then to midnight.

July 15th : Twenty-two operations in all, including one abdomen and five compound fractures of the femur. As an example of "Aussie" toughness—a patient about to be operated on at first refused treatment but, after hitting our orderly in the jaw, gave permission saying: "If you're going to do anything you'll do it my way and how I like it, and them's the words of a dying man." He passed away peacefully the next morning.

July 16th : A routine day, a number of P.O.W.s arriving. Operated on two abdomens. A good deal of gunfire during the day. A cheerful New Zealand patient remarked that we had "the bastards on the run."

July 17th : A quiet day.

July 18th : Fifteen operations; much gunfire and air activity.

July 19th : This camp which, a fortnight ago, seemed to consist of a collection of scattered tents, has now taken on a very definite personality. Every tent is now known to us. We know what goes on inside and who are

working there. What at first appeared to be an impersonal collection of canvas has now become a familiar tented township.

July 20th : Our chaplain had been absent on sick leave for some days and a new one was due to arrive at any time. An operation was about to commence when an orderly entered the operating tent and announced : " The new chaplain will be available for the burial service at eleven o'clock," a particularly gloomy start to the day's work.

July 21st : An order arrived to move forward three miles over the ridge.

July 22nd : Here we found the Heavy Section of the C.C.S., a collection of over forty tents, consisting of : Wards, Resuscitation tents, reception tents, offices, X-ray units, dynamo vans, stores, etc. In fact there was everything which goes to the making of a hospital under canvas. Our little unit erected its tents to the north of this camp and by noon we were ready to work. We soon started and we finished after midnight, having dealt with some very severe battle casualties.

July 23rd : Fairly strenuous work up to 1700 hours when we were ordered to rest and be ready again at midnight.

July 24th : There appears to be a lull in the battle as we had an undisturbed night. In the late afternoon the whole unit had a bathe in the sea, some four miles away. On the way back came on some fig trees and gorged ourselves with green figs. The moon is now three-quarters full and the nights are beautiful except for those flying things that go " boomp " in the night.

July 28th : For three days we were idle. We spend the time reading, with long discussions on the war, politics, religion, the opposite sex and post-war reconstruction. In the end we satisfy ourselves that, given the power, we could produce a much happier existence than mankind has hitherto enjoyed.

To-day I am ordered to the Base to collect a new Surgical Unit—No. 3 Field Surgical Unit. A plane is available at a near-by desert airfield. It was taking wounded men to the Base. I dismissed the medical orderly and took his place. As he left I inquired the extent of my new appointment. It did not seem highly technical, in fact the only necessity appeared to be to produce a tin bucket as and when a patient was about to vomit. There were thirteen men in the plane, most looking pretty sick already.

The machine was an old one and when they started the engines there was such a rattle that I did not feel any too good myself. At last we were off and up to about 3,000 feet. It was very bumpy and the machine swayed horribly. I looked down at all the familiar landmarks and then took one look at my patients. I realized immediately that it was not necessary for me to have a medical degree in order to know that the tin bucket was wanted right now. Only just in time ; now another ; and so on, to and fro, up and down the narrow cabin. The pilot looked through with some concern, especially as a South African soldier was suffering from persistent vomiting. He was very shocked, with a feeble pulse so I laid him flat on the cabin floor. Soon, another collapsed, unconscious, after what appeared to be an epileptiform fit. I note that on his field card he had been blown up by a mine the day before. After thirty minutes' flying we landed and waited ten minutes. Here a young pilot

on leave managed to squeeze on board with only a parachute for luggage. When we are in the air again he observes that two planes carrying wounded had been shot down a few days before. I hoped he would ask me to share his parachute should we be so unfortunate.

By this time a fresh chorus of vomiting rose above the roar of the engine and the remaining forty minutes of the journey is best left undescribed. Sufficient be it to say that I required two stretchers for my patients at the end of the journey. After this trip I am convinced that men who are wounded, tired and suffering from the after-effects of a recent battle should not be subjected to what is, perhaps, their first experience of air travel. The unconscious "head case" is probably the ideal passenger.

August 12th : After fourteen days spent collecting personnel and equipment from the Base Depot I returned to the Desert complete with a staff car, 3-ton lorry and seven Other Ranks. There is much idle bantering at my prolonged stay at the Base which is constantly referred to as my "leave." (Some leave !)

Reviews.

AIDS TO MEDICAL DIAGNOSIS. Sixth Edition. By G. E. Frederick Sutton, *M.C.*, *M.D.*, *M.R.C.P.* London : Baillière, Tindall and Cox. 1946. Pp. viii+308. 46 figs. Price 6s.

This little pocket-book, the author points out, makes no pretence at being a textbook on Medical Diagnosis yet it is intended to be more than a cram book. Within these limitations of being neither the one thing nor the other it contains a great deal of information, in small compass. Some of the statements are necessarily dogmatic and some of the descriptions of disease are very brief indeed. Nevertheless, the author has for the most part managed to keep "the fine balance" he sets out to achieve. The student wishing to run over rapidly the main points of symptomatology may find this a useful little book to have about him for revision purposes.

The price of the book is very reasonable.

G. F. H.

AN INTRODUCTION TO BACTERIOLOGICAL CHEMISTRY. Second Edition. By C. G. Anderson, *Ph.D.Birm.*, *Dip.Bact.Lond.* Edinburgh : E. & S. Livingstone, Ltd. 1946. Pp. x+500. Price 20s. net.

Since the first edition of this book was published in 1938, an enormous amount of work has been done in the subject of Chemistry as applied to Bacteriology, especially in the realm of chemotherapeutics and antibiotics ; hence the great need for a second edition of a very useful book.

The book is divided into three main parts :—

Part 1 gives a general description of pH values, oxidation-reduction potentials, colloids, enzymes and a description of the chemical composition, so far as is known at present, of bacteria, fungi and yeasts. In view of the

increasing importance of oxidation-reduction potentials and their effect on the growth of organisms, a little more space devoted to this subject might have been desirable, especially as students find it somewhat difficult.

Part 2 comprises most of the book and describes in detail the metabolism of organisms. The author has written this very clearly and students should not have any great difficulty in following the chemistry of this subject, although it is somewhat abstruse.

Part 3 in which the author has described some of the reactions involved in immunology including antigens, antibodies, haptens, etc., and has explained the mechanism of some of the reactions.

In two very useful appendices are given methods for the isolation and identification of metabolic products and the synonyms of micro-organisms compared with the official names given in Bergey's "Manual of Determinative Bacteriology."

One can have no hesitation in recommending pathologists and bacteriologists and even chemists, who have to study bacteriology to read this book; it will both open up new vistas and explain many puzzling things in the study of living organisms.

The book is well printed in very readable type on good paper and has no printing errors of any importance. S. E.

SYNOPSIS OF SURGICAL ANATOMY. Sixth Edition. By A. Lee McGregor M.Ch.Edin., F.R.C.S.Eng. Bristol: John Wright and Sons, Ltd. Price 25s. net.

In the sixth edition of this well-known and deservedly popular book, a few alterations have been made to bring the subject matter up to date, but the plan generally follows that which has proved so successful over the past fourteen years.

The book contains a mine of information, which induces in the beholder a desire to possess it. It is strongly recommended to medical officers in the Army. D. C. B.

SURGERY OF THE HAND. Second Edition. By R. M. Handfield-Jones, M.C., M.S., F.R.C.S. Edinburgh: E. & S. Livingstone, Ltd. Pp. 156. 104 illustrations (some coloured). Price 20s. (postage 7d. Home).

The author intends his book for general practitioners, industrial medical officers and casualty house surgeons, and in this second edition he follows the general plan adopted for the first edition. Chapters on Burns and Amputations have, however, been added, thereby increasing the value of the book.

The book is excellently produced, is of handy size, and is recommended to medical officers in the Army. D. C. B.



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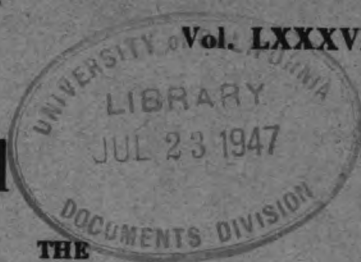
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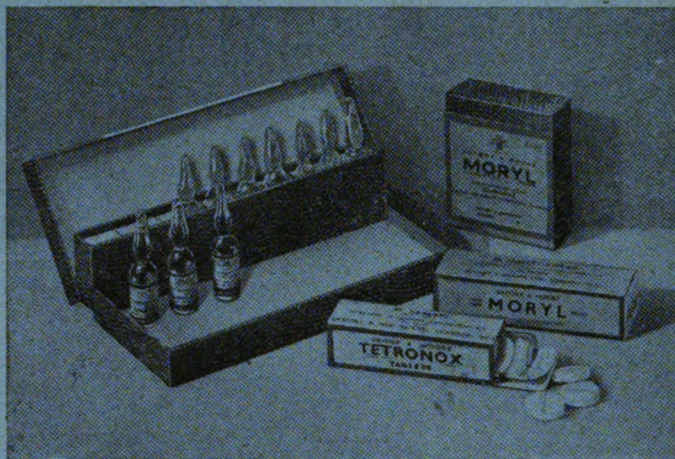


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Journal of the Royal Army Medical Corps.

Original Communications.

AN OUTLINE OF THE ROLE OF THE MEDICAL SERVICES IN THE SECOND (British) ARMY'S CAMPAIGN IN NORTH-WEST EUROPE (1944-45).

Part I.

BY

Lieutenant-Colonel R. GWYN EVANS, *M.B.E.*, *M.B.*, *M.R.C.P.*

Royal Army Medical Corps (T.A.)

Late A.D.M.S., Second Army—B.L.A.

LIST OF MILITARY ABBREVIATIONS.

ADS	=	Advanced Dressing Station	FTU	=	Field Transfusion Unit
ADMS	=	Assistant Director Medical Services	Gds	=	Guards
Amb Car	=	Ambulance Car	Gen Hosp	=	General Hospital
Armd	=	Armoured	GOC	=	General Officer
Bde	=	Brigade			Commanding
Br	=	British	Lt Fd Amb	=	Light Field Ambulance
CCP	=	Casualty Collecting Post	LO	=	Liaison Officer
OCS	=	Casualty Clearing Station	L of C	=	Lines of Communication
CEP	=	Casualty Embarkation Point	LSI	=	Landing Ship Infantry.
			LST	=	Landing Ship Tanks
			MAC	=	Motor Ambulance Con- voy (90 amb cars)
Cdn	=	Canadian	Mil Gov	=	Military Government
DADMS	=	Deputy Assistant Director Medical Services	Op	=	Operation
DDMS	=	Deputy Director	ORs	=	Other Ranks
Div	=	Division	PAC	=	Preventive Ablution Centre
Det	=	Detachment	Port Det	=	Port Detachment (medi- cal stores)
DP	=	Displaced Persons	PW	=	Prisoner of War
DUKW	=	Amphibious Craft	R	=	River.
Fd Amb	=	Field Ambulance	Sec	=	Section.
Fd Hyg Sec	=	Field Hygiene Section	VDTC	=	V.D. Treatment Centre
FDS	=	Field Dressing Station			
FSU	=	Field Surgical Unit			

PREFACE.

AFTER the successful conclusion of operations in North-West Europe in June, 1945, Headquarters Second (British) Army was scheduled to be disbanded, and in order to preserve a full record of the planning and execution of the Army's campaign, the Army Commander (Lieut.-General Sir Miles C. Dempsey, *K.C.B.*, *K.B.E.*, *D.S.O.*, *M.C.*) directed members of his staff concerned with the planning and administration to compile an historical record of the campaign in its various phases, giving consideration to the lessons derived from their experience. The author, as Assistant Director of Medical Services (Operations), was responsible for compiling from his personal experience the historical record of the work of the Medical Services for incorporation in this official history.

The medical contribution has been used as a basis for this paper, and, in order to illustrate the medical plans for the various phases of the campaign from the original Normandy landings, a brief account has been given of the progress of the general operations in each phase of the campaign covered in the first chapters. In the following chapters detailed consideration has been given to some of the major medical administrative problems which arose out of the campaign; the problems are dealt with mainly from the medical administrative aspect and no attempt has been made to go into clinical details which is the realm of the specialist advisors and consultants.

As the author was intimately concerned at Corps and Army level with the medical planning and practical administration of the Army's Medical Services throughout the whole campaign, the account given is based on his own personal observations, and views expressed are his personal views and not necessarily "official views." In this respect, therefore, the work is an original one, based on personal experiences and in addition to providing an historical record of the plans and work of the Medical Services in the N.-W. European campaign, it also indicates the direction in which further study should be made of the medical problems arising from the needs of a modern mobile field army and from the necessity for providing medical relief from civil distress.

LIST OF PRINCIPAL DATES OF MAJOR OPERATIONS.
(June 6, 1944 to May 5, 1945.)

<i>Date</i>	<i>Code Name</i>	<i>Nature</i>	<i>Main Effort</i>
6 Jun—8 Jun		The landing	1 and 30 Corps
9 Jun—14 Jun	Op PERCH	Thrust to VILLERS BOCAGE	30 Corps
25 Jun—30 Jun	Op EPSOM	Crossing of R ODON	8 Corps
8 Jul—10 Jul	Op CHARNWOOD	Assault on CAEN	1 Corps
16 Jul—20 Jul	Op GOODWOOD	Attack East of CAEN	8 Corps
30 Jul—12 Aug	Op BLUECOAT	The breakout from the bridgehead	8 and 30 Corps
13 Aug—21 Aug		FALAISE Gap	
25 Aug—28 Aug		Crossing of the R SEINE	30 Corps
29 Aug—5 Sep		Pursuit into BELGIUM	30 and 12 Corps
6 Sep—17 Sep.		Battle for the approaches to HOLLAND	30 Corps

<i>Date</i>	<i>Code Name</i>	<i>Nature</i>	<i>Main Effort</i>
17 Sep—26 Sep	Op MARKET GARDEN	Seizure of Dutch river crossings in conjunction with airborne troops	8, 12 and 30 Corps
12 Oct—20 Oct	Op CONSTELLATION	Clearance of area west of R MEUSE	8 Corps
22 Oct— 6 Nov	Op PHEASANT	Clearance of 's HERTOGENBOSCH area	12 Corps
14 Nov— 3 Dec	Op MALLARD and Op NUTCRACKER	Clearance of the VENLO Pocket	8 and 12 Corps
18 Nov—23 Nov	Op CLIPPER	Capture of GEILEN-KIRCHEN	30 Corps
19 Dec—15 Jan		Battle of the ARDENNES	30 Corps
16 Jan—25 Jan	Op BLACKCOCK	Clearance of area between R MAAS and R ROER	12 Corps
8 Feb—11 Mar	Op VERITABLE	Clearance of REICH-SWALD Area up to R RHINE	30 Corps (under command First Canadian Army)
23 Mar—30 Mar	Op PLUNDER	Crossing of R RHINE	12, 30 and XVIII United States Airborne Corps
31 Mar—22 Apr		Advance to R ELBE	8, 12 and 30 Corps
24 Apr—28 Apr		Capture of BREMEN	30 Corps
29 Apr—30 Apr	Op ENTERPRISE	Crossing of R ELBE	8 and XVIII United States Airborne Corps
1 May— 5 May	Op VOLCANO	Advance to the BALTIC	8 and XVIII United States Airborne Corps

CHAPTER I.

THE MOUNTING OF OPERATION "OVERLORD" AND THE LANDING IN NORMANDY.

THE medical planning for the invasion of North-West Europe was, of course, part of the general staff planning, but in certain respects, special consideration had to be given to certain major medical problems which have been outlined below and upon which the complete success of the operation was bound to depend. Medical arrangements for the Force whilst assembling and concentrating in Southern and South-Eastern England was a War Office responsibility, utilizing medical units of Home Forces. Second Army's medical responsibilities therefore began with the voyage across the Channel and its attendant dangers from sea and air.

It was arranged that casualties occurring in the first flight assault craft would return to the parent ship for evacuation; casualties in subsequent flights would be landed on the beaches as craft "touched down" and evacuated to R.A.P.s or Beach Dressing Stations. Casualties in larger craft and ships were to be evacuated by normal naval channels. Each assaulting battalion was to be accompanied by a section of a Field Ambulance with light medical equip-

ment (packed into improvised waterproof packs); these sections were to co-operate with Regimental M.O.s until recalled to join their parent Field Ambulance when it was ready to function as a unit.

Headquarters of Field Ambulance equipped to "assault" scales landed with the assaulting brigades (one to each brigade) to form an Advanced Dressing Station (ADS). Evacuation from ADSs to Beach Field Dressing Stations (FDSs) was to take place as soon as Beach FDSs were established after their landing with the first tide; each Beach FDS was to be accompanied by a Field Surgical Unit (FSU) and Field Transfusion Unit (FTU) to provide facilities for emergency surgery.

Each of the Assaulting Corps (1 Corps and 30 Corps) was to establish from its own medical resources casualty embarkation points (CEPs), through which casualties were to be evacuated to unloaded LSTs returning to the United Kingdom. Many LSTs had been fitted with racks to carry stretchers, and evacuation was co-ordinated by a medical administration officer—the DADMS (Embarkation) working in conjunction with the naval officer in charge.

Casualty estimates for the operation were, of course, high, as it was upon the success of operation OVERLORD that the final outcome of the war so largely depended; 5,000 casualties were expected on D-Day itself, with the total rising to 26,000 by D + 14. It was therefore of paramount importance not only that the Medical Services were well trained and prepared for their important role, but also that the maximum holding capacity was established ashore without delay. To this end, it was planned to "phase in" on D-Day a total of three Casualty Clearing Stations (CCSs), each with an FSU and FTU attached (to augment the surgical potential of each CCS to three surgical teams). Two CCS were to be landed in the 1 Corps sector on the left (one to each Beach Sub-Area) and one in the 30 Corps sector on the right. These units were to be organized to increase their holding capacity from its normal 150-200 cases up to a total of 500 cases.

As the "build-up" proceeded it was hoped to have ashore by D + 3/4 two small (200 bed) General Hospitals and two further CCSs, with detachments of nursing officers and elements of special surgical units: a neuro-surgical team and a maxillo-facial team.

Hospital carriers were not expected to be off the beaches until D + 3, and hospital ships not before D + 14 or later. Moreover, air evacuation could not be expected to commence before D + 12 to D + 14. Full use would therefore have to be made of returning LSTs, if necessary ferrying casualties out to the LSTs in DUKWs.

Demands for replacement medical equipments would be met from Beach Maintenance Blocks of medical equipment, each block weighing 1¼ tons and comprising drugs, dressings, instruments and transfusion fluids. 4 to 5 tons of medical equipment were to be landed daily for each of the assaulting corps. Detachments of the forward distributing sections of the Base Transfusion Unit would be landed on D + 3, and would maintain their supplies initially by fast naval launch from Bristol.

Finally, to meet the expected heavy demand for stretchers and blankets, it was arranged (i) that each assault Division would land with an extra 750 stretchers, (ii) CCSs and General Hospitals landing early would carry 400 additional stretchers, (iii) from D + 1 to D + 4, 1,200 stretchers would be landed daily over the beaches, the number being reduced after D + 5 to 250 daily. Equivalent scales of blankets (three per stretcher) and pyjama suits (5 suits to 4 stretchers) were phased in.

It was envisaged that as initial situation clarified, and Corps attained their objectives, a normal line of medical evacuation would begin to form; with the arrival of 600 bed General Hospitals from D + 7 it was to be hoped that by D + 15/16 a minor Medical Base (comprising 2,400 beds) would have been formed by Army, possibly extending to a minor Medical Base sited to facilitate evacuation through a port as the tactical situation developed.

THE LANDING IN NORMANDY AND THE BUILD-UP.

The assault, which was to play such a vital and decisive part in the World's history, took place, after a twenty-four hour postponement, on June 6, 1944. It was carried out as a combined Anglo-American assault on the beaches of Normandy between the mouth of the River Orne and the Cherbourg Peninsula.

On the British Sector, from the mouth of the River Orne to Port en Bessain, it was carried out by three Seaborne and one Airborne Divisions in weather which, although initially calm, was not wholly suitable for seaborne operations and was likely to deteriorate; this naturally had its repercussions in the case of evacuation of casualties and proved an added hazard to the Medical Services. The disposition of the Assault Formations was as follows:—

Right	30 Corps	50 (N) Div
Left	1 Corps	3 (Cdn) Div
		3 (Br) Div

The 6 Airborne Division dropped on the East of the River Orne.

The landings were entirely successful but it was soon obvious that initial enemy resistance was likely to be stronger on the left than the right and so it proved. The Airborne Landing during the night June 5/6 was successful in its capture of the Orne bridges and establishment of a bridgehead on the east of the river, but the storming of Caen was delayed.

At this stage responsibility for medical control was vested in DDsMS Corps each for his own area, until on June 11, 1944, Second Army took over the administrative control of the bridgehead and at the same time 11 L of C for the Beach Sub-Areas.

The thorough training of the medical units of all types which were included in these Beach Sub-Areas had proved its worth and the surgical and blood transfusion potential provided in them supplied a life-saving factor unique in an operation of this scale.

On D-Day 855 casualties were evacuated by LST.

Annexure A gives details of some of the work carried out by the Medical Services in the initial assault and the period immediately following it.

In all there were five Beach Groups and to each of these two FDSs were allotted together with Field Surgical and Field Transfusion Units. In this way the complete landing area was covered, and to deal with these three casualty evacuation points were set up, one for each Sector, until by the establishment of a deeper bridgehead evacuation could be concentrated into one main CEP at Courseulles.

These FDSs together with the Assault Divisional Medical Units carried out all the initial collection, treatment and evacuation of casualties until the arrival of the Casualty Clearing Stations and 200 bed General Hospitals which formed the next link in the chain.

These arrived and were established in their respective Corps areas.

1 Corps	16 CCS	Hermanville
	32 CCS	Reviere
30 Corps	3 CCS	Ryes
	10 CCS	E of Bayeaux (St Vigor)

Army Units.—The build-up of these units proceeded synchronously with those of the Corps. Details of actual dates of arrival of medical units (phased in by Army) are appended at Annexure B.

35 CCS landed June 9 and opened at Reviere.

81 Gen Hosp (200 beds) landed 10 June and opened at Ryes.

86 Gen Hosp (200 beds) " 10 " " " " " La
Delivrande.

84 Gen Hosp (200 beds) " 17 " " " " " Ryes.

88 Gen Hosp (200 beds) " 17 " " " " " La
Delivrande.

79 Gen Hosp (600 beds) " 14 " " " " " Bayeux.

From this it will be seen that by June 18 it was possible to formulate a definite scheme for the evacuation of casualties and the normal chain from Corps to Army units was established.

The method consisted in the formation of small medical areas along the road Ryes-Douvres and in the neighbourhood of Bayeux to centralize the evacuation across the beaches at Courseulles.

Initially there were three medical areas at Ryes, Reviere and La Delivrande and eventually as Corps units moved out to be replaced by Army units two Sectors for evacuation were established.

(a) Western	Bayeux	79 Gen Hosp
	Ryes	81/84 Gen Hosps
(b) Eastern	Reviere	32/55 CCSs
	La Delivrande	86/88 Gen Hosps

Evacuation by sea continued from the main CEP at Courseulles.

Bayeux, which had been captured on June 8, later became the main Medical Base Area and following the arrival of 79 General Hospital, Nos. 20, 75, and

77, all 600 bed General Hospitals, landed on the night June 22/23, No. 20 opening at Bayeux and 77 at Revers.

Evacuation.

Sea.—Evacuation by sea was initiated from CEPs as indicated above and from June 11 control of all evacuation was exercised by ADMS 11 L of C area. In this way it was intended to avoid difficulties of irregular sailings of Hospital Carriers and to ensure that LSTs sailed loaded to capacity.

The initial evacuation commencing on D-Day was by LST, and this continued for a considerable period as, although, a Hospital Carrier was loaded on D + 3 this proved tedious when compared with the ease of loading LSTs. A service of Hospital Carriers as required commenced on June 25 (D + 19).

Resulting from the inclement weather, and, despite the reluctance of the Navy to do so, the beaching of all LSTs proved a blessing in disguise to the Medical Services as it enabled evacuation to be effected direct from the beach, a very much easier procedure than would have been possible using DUKW to LST afloat in the rough weather that prevailed.

All evacuation by sea was eventually concentrated at Courseulles through a CEP formed by 2 and 34 FDS.

Within the bridgehead Corps initially evacuated direct to CEPs, but from June 15 commenced to evacuate direct to Army units, and from June 18 the normal chain of evacuation was in full working order.

Air.—Evacuation by air commenced on June 13 (D + 7) when 29 cases evacuated and a further lift was available on June 15.

At this stage, however, air lift was always an uncertain factor partly due to the weather, partly due to the uncertainty at which airfield aircraft would arrive and in what numbers they would be available. The absence of any holding unit on the airfields increased these difficulties. The value of an efficient cushion on the airfield was clearly demonstrated and from this time on it became the normal practice to set aside one CCS for this purpose.

Special Services.

Surgery.—The surgical plan for the first week of the operation worked extremely well; as was natural 95 per cent of the work carried out was surgical, but the surgeons themselves, by their judgment and careful selection of cases to be operated upon, added greatly to the success of the arrangements and the general welfare of the wounded. The percentage of cases dying post-operatively was approximately 6 to 7, and the abdominal mortality something between 25 and 30 per cent, a very creditable figure under the existing conditions.

Blood Transfusion.—This service worked very successfully; six FTUs (two to each Beach Sub-Area) landed, five on D-day and one on D + 1, each arriving with blood in refrigeration: in this way 1,150 bottles were landed. Re-supply was effected from D + 1 by naval despatch boat service at the rate of 400 bottles a day up to D + 6 and 300 bottles a day thereafter until air transport was commenced on June 23 (D + 17).

X and Y Advanced Blood Banks landed on June 11 (D + 5) each with three refrigerators and by D + 11 all thirteen Second Army FTUs were ashore. In

certain instances where supply was temporarily disorganized local bleeding of donors met emergency demands.

Penicillin.—Large numbers of patients were treated with penicillin, all at this stage by injection, and first impressions as to its value were definitely favourable. Throughout the campaign distribution has been carried out through the agency of the Blood Transfusion Service.

Hygiene.—The health of the troops was excellent, and hygiene problems did not loom nearly as largely as was expected in the beach areas, as the discipline of the troops was excellent.

Water was available in good supply and excellent in quality. Bathing facilities were soon forthcoming.

The general appearance of the civilians was much better than was anticipated, and all looked well, although in many cases it did not appear that they were too pleased at this upset to the even tenor of their way, or perhaps they were still nervous as to the probable duration of our stay.

Some cases of malaria began to recur and for a time this became a minor problem in certain formations. It later became apparent that malaria was endemic in the Caen area and certain cases occurred contracted particularly in the low-lying ground east of the River Orne.

Individual Operations.—Although it is not intended in any way to give a full tactical account of the operations, certain individual battles will be outlined to provide background for the medical problems that arose.

The first of many operations commenced on June 10 (Operation PERCH) with a thrust to Villers Bocage by 7 Armoured Division u/c 30 Corps. This achieved only varying success and this area became later the scene of much stubborn fighting; in fact at this stage the villages of Tilly-sur-Seulles and Villers Bocage changed hands on several occasions, only to fall finally into our hands at the commencement of the break-out. For this operation the initial lay-out of medical units remained unchanged.

With the arrival of 8 Corps, as yet without their CCSs, and the commencement of Operation EPSOM, 32 CCS was loaned temporarily by 1 Corps and full use also made of 10 CCS and 79 General Hospital in the Bayeux area. The narrowness of the bridgehead and the proximity of the start line to the excellent Bayeux-Caen Road made the problem of evacuation in the initial stage easy. Both CCSs of 8 Corps (33 and 34) arrived in time to take part in the later stage of this operation and Operation JUPITER which commenced on July 10 and was carried out by the same Corps as an attack to enlarge the Odon bridgehead. An analysis of the causal factors of various types of wounds treated at a CCS is attached at Annexure C, and at Annexure D is a classification of casualties (by wounds) admitted to two CCSs for surgical treatment.

The crossing of the River Odon in Operation EPSOM was the first assault river crossing effected in this campaign but did not present any of the usual problems of an assault of this nature as the bridges were captured intact.

At this stage an 8 Corps medical area was established at Sequeville and 3 CCS of 30 Corps was moved forward to Jerusalem, otherwise although certain regrouping took place the main medical areas remained unchanged.

Operation CHAINWOOD, the storming of the fortress of Caen, was undertaken by 1 Corps made up of 3 (Br), 3 (Cdn) and 59 Divisions. Casualties were evacuated to the Delivrande group of hospitals. This operation lasted from July 8 to 10 and in effect Operation JUPITER was a sequel to this.

Operation GOODWOOD which commenced on July 16, was the first large-scale armoured attack of the campaign. It consisted of an assault by 8 Corps with three Armoured Divisions (Guards, 7 and 11 Armoured Divisions) which were moved with the strictest security precautions to their concentration areas. This attack was preceded by feints by both 12 and 30 Corps, 12 Corps on July 15 directed on Esquay and 30 Corps on the same day with Noyers as their objective. The actual assault was also to be aided by an attack on the right flank by 2 Cdn Corps whose task was to clear the areas of the Colombelles factory, Vancelles and Giberville; at the same time 1 Corps was to protect the left flank of 8 Corps by an attack directed on Troarn.

The operation by 8 Corps entailed the concentration of 11 Armoured Division in the very small bridgehead east of the River Orne and the passage of the two other Armoured Divisions (Guards and 7) across the River Orne commencing not before H hour. From the nature of this build-up certain special medical problems arose which are of interest. It was vital that no interruption to the passage of armour from west to east should occur and therefore DIMS 8 Corps understood that there should be no use at all of the bridges by ambulance cars; special arrangements for the evacuation of casualties had therefore to be made as it was quite impossible to organize sufficient holding capacity or adequate surgical facilities in the small and already overcrowded bridgehead. During the night of July 15/16 a small footbridge connecting the east bank to an island in the middle of the river was made fit for use, and a detachment of 16 Lt Fd Amb specially detailed to organize all evacuation by this route; the island about one mile in length was connected to the west bank at the mouth of the river at Ouistreham by a lock bridge. By concentrating MAC cars on the island it was possible to evacuate all cases with only the slight interruption of a short hand carry across the footbridge, and certainly obviated any great delay in the operative treatment of the serious surgical cases.

Evacuation was again to the Delivrande group of hospitals which had been reinforced for the occasion by 33 CCS, this unit to be used as far as possible only for transportable cases so that if a major break-through became a possibility this CCS would retain its mobility and be available to 8 Corps.

The other CCS of this Corps (No. 34) was meanwhile closed in reserve, just west of Caen, so that any rapid move required could be effected through Caen and so to the south to avoid the long route from the north taken by the armour in the initial attack.

Although a considerable advance was made this attack at no time assumed the proportion of a real breakout largely due to the quick and skilful use of their anti-tank defences made by the enemy. Apart from stubborn fighting still taking place on the right flank and small advances made as opportunity occurred this proved the last operation of a major nature before the commencement of the actual breakout.

COMMENTARY.

At this stage at 1200 hours on July 22 1 Corps passed to command of First Cdn Army who took over the responsibility for the Delivrande group of hospitals. This first phase had proved a real test for the Medical Services in that it was the period when casualties were heaviest during the campaign; on the other hand owing to the narrowness of the bridgehead distances to medical units were never very great nor were there the problems of rapid movements of CCS and Gen Hosp which developed later. Once the initial stage of the Assault was over and the evacuation by sea and air finally established the normal organization was soon set up and no major problems of any seriousness presented themselves.

Certain interesting points arise from a general survey of this period:—

(a) The Use of Medical Units.

General Hospitals.—It was inevitable in the early stages that all Gen Hosps ashore performed the functions of CCSs, this with particular reference to the 200 bedded hospitals which certainly in the Delivrande group carried out this role for a considerable period; except for a very short period in the pursuit through Germany they were not used again in this way.

FDSs.—At the end of June (approx. 29) the second FDS which had been allotted to each Corps in the UK and trained to act as an exhaustion centre was released from its duties with a Beach Group and joined its respective formation. This proved the greatest possible asset to Corps medical resources.

Corps Med Units (CCS and FDS).—Experience in the bridgehead showed that the ideal set up of a Corps medical area for heavy (and semi-static) fighting of this type was if possible two Casualty Clearing Stations with certainly one and if possible two smaller units alongside. Whether they were both Field Dressing Stations or one a Lt/Fd Amb did not matter. In this way the smaller units could act as a filter and take off all the sick, lightly wounded and exhaustion cases leaving CCS to deal with only the more serious cases.

This method also facilitated the setting up of a true advanced surgical centre, the smaller units going ahead together with RECCE parties of the CCSs and a surgical and transfusion element to deal with all urgent surgery. As soon as possible, probably one or two days later, depending on the tactical situation, the first CCS arrived, set up alongside in the area already prepared by its RECCE party and took over the surgical commitments.

Operation BLUECOAT provided the first opportunity for the setting up of an Advanced Surgical Centre: this was established at St. Jean des Essartiers.

With the medical area containing two CCSs and two smaller units, reception of casualties switched from one to the other to give much-needed rest to all ranks, in particular the surgeons. Various methods of achieving this were tried with CCSs either based on time periods, on the number of patients admitted or on the numbers awaiting operation. The final conclusion was that in busy periods the switching of casualty reception was best determined by the number of cases awaiting operation, but in easier times by twenty-four hour periods. This latter method makes it possible for everyone to get gener-

ally tidied up, and the surgeons to deal more thoroughly with the post-operative care of their cases. In times of heavy stress it was frequently found necessary to import extra medical officers from Divisional units which were resting or in reserve to help both in the post-operative wards and in reception, the two heaviest commitments of a CCS in action.

FSUs.—The ample supply of Field Surgical Units landed in was an enormous asset and even with the number available in the days of heavy casualties surgeons were hard put to it and worked long hours to cope with the situation.

The normal allocation which was soon arrived at of three surgical units to a CCS proved the right answer as, with the two intrinsic surgeons regular periods of duty could be arranged which, even in the heaviest time, allowed some rest for these overworked personnel.

The procedure which was tried later by one or two formations of increasing the number of FSUs to a CCS was at no time a success, as it considerably increased the post-operative and nursing problems.

It was also essential that at least one FSU was always attached to each 200 bedded Gen Hosp (which only carried one surgeon on its establishment).

The use of the specialist teams, maxillo-facial and neuro-surgical, will be discussed in a more detailed manner in the full history. They did excellent work and were in times of stress each split up into two halves to cover the need of the forward and back areas when distances were excessive. This is an extravagant method and does not produce the best results and should only be resorted to in times of emergency, when operations are taking place over a wide front with long lines of evacuation.

FTUs.—These were normally, as they should be, used at CCS level only. FTUs were occasionally employed at other units, if acting as a CCS. They must be where urgent major surgery is carried out, to produce their optimum effect. This of course may apply to an Advanced Surgical Centre as well, but if it means the denuding of the CCS it should not be resorted to as FDS officers were specially trained for this purpose and should be quite capable of dealing with the small number of cases that should be admitted to an Advanced Surgical Centre if triage has been carried out correctly.

On one or two occasions when very heavy casualties were expected FTUs were stationed at Advanced Dressing Stations and did magnificent work but events definitely proved that it is not the right place for them.

Divisional Medical Units.—The lines on which training had been carried out in England proved to have been correct and units reaped the reward of their keenness in direct proportion to the work they had put in.

Units were used in the manner in which the majority had trained in exercises. The few formations which had still adhered to the policy of automatically allotting one section of a Fd Amb Coy to each Bn of the Bde they were serving were very soon disillusioned and reverted to the normal.

Many formations experimented with new uses and lay-out of their units, some with great success. Mention should be made of the splitting down of an FDS either into two equal or unequal parts or into three to provide a greater transfusion potential to help the Fd Ambs; several infantry divisions experi-

mented in this way with their second Field Dressing Station. The formation that split into three could then supply one-third to each Fd Amb as an extra specialized shock team if all were operationally engaged or in proportion of 2 : 1 if not, or all three parts to one Adv Dressing Station if this was heavily committed. The same formation also split its Fd Ambulance HQ into three equal parts enabling one, two or all three to be utilized depending on the scale of the engagement. This facilitated the allocation of the FDS shock teams and enabled the personnel to get proper rest in a big battle. This arrangement always enabled the second FDS of the Division to be used in the rear Divisional area to hold sick, minor wounded and exhaustion cases.

The breakdown of a Field Dressing Station into two unequal parts had been practised by one formation in the UK to build up the light section to a certain degree and enable it to have an independent existence (which was not originally intended in the Hartgill scheme). This proved to be particularly useful in the case of an Armoured Division for which the idea was originally formulated.

The bridgehead period also proved the value of a medical area at Divisional level too by the siting of either the whole or part of a Divisional FDS alongside the Advanced Dressing Station to act as a filter for sick, minor wounded and exhaustion just in the same way as has been described in the Corps Med area.

Figures to prove this are as follows:—

July 10 ADS formed by FD Amb dealt with	371 cases
FDS filter	" " 323 "
July 11 ADS formed by FD Amb dealt with	323 cases
FDS filter	" " 542 "

The units were the same in both cases and it shows how overloaded the ADS would have been without this extra cushion. It enabled the Fd Amb to pay so much more attention to the splinting and preparation of the heavier cases to ensure a more comfortable journey.

(b) *The Exhaustion Case.*

Psychiatry in all its activities has been a very interesting study throughout the campaign, and to those who had not met "the exhaustion case" to such an extent before it soon became a very major problem.

Subsequently the numbers never approached the proportions that they attained in the Normandy Bridgehead. But at that time they assumed serious proportions in some formations and appeared likely to do so in others too.

It was soon apparent that even to the extent of erring on the wrong side as many cases as possible must be kept in the Divisional area and to this effect instructions were speedily given to senior administrative officers to hold all minor cases.

Corps each set up their own exhaustion centres to which the more serious type of case was sent whilst behind this again was Army Centre to which cases for evacuation to the UK were sent.

A more detailed description will be given in the complete history of other aspects of the work of the psychiatrists.

(c) *Supply in the Early Days.*

The supply of medical maintenance equipment was initially by medical maintenance blocks, each half block weighing $1\frac{1}{4}$ tons.

In the first instance before the arrival of Adv Depots of Medical Stores they were delivered to OBDs¹ at which were stationed certain RAMC personnel for the purpose of collecting, identifying and sorting the equipment. Special markings of the packages were arranged to facilitate this procedure.

This method worked well and continued until D + 40.

After operation CHAINWOOD, a system of supply to Corps by the formation of a mobile element comprising two three-ton lorries based on each Advanced Depot Medical Stores was instituted, and has continued throughout the campaign.

In the very early days an urgent request from First US Army for a large supply of Mepacrine was met and very much appreciated.

The question of blood and penicillin has been dealt with. Other items such as presterilized dressings, stretchers and blankets all arrived satisfactorily, and a special drill soon devised to make replacement in all cases more effective. The wastage of stretchers and blankets due to air evacuation and other inadequate replacements was soon put right.

(d) *Transport.*

Fortunately the loss in transit of Amb Cars, water trucks and the basic transport of medical units did not assume serious proportions and gave no cause for concern.

(e) *The Prevention of Infectious Diseases.*

In view of the incidence of infection amongst civil population on the Continent with the increased risk of infection to the troops, special instructions were issued, not only on this special subject, but also all matters of water discipline and sanitation. Approximately 100 per cent protection had been assured by inoculation and vaccination against the enteric fevers. The value of these measures was exemplified when later in the campaign a serious outbreak of typhoid occurred in the 6 Gds Tk Bde. What would have resulted had this not been so does not bear conjecture.

(f) *Documentation.*

A special effort was made before D-Day to simplify this as far as possible, but there has been even then considerable delay in the implementation of suggestions put forward at that time.

(g) *Hygiene.*

No major problems were encountered in the early stages. The discipline of the troops was excellent and it was not until the fall of Caen on July 10 that the Army was presented with the problem of a large town with water supplies and sewage systems completely disrupted.

One problem which did persist throughout these early days was the case of dead animals, cattle in particular. These existed in very large numbers

¹ Ordnance Beach Depots.

and in times of heavy fighting it was almost impossible to cope with the situation. However, active measures were taken by all formations, and a great assistance in the prevention of this danger was the formation of cattle compounds in the rear areas into which all cattle from the forward fighting zone were driven. The same state of affairs became a problem in the Falaise pocket itself and a Bde from a disbanded Division was given the task of clearing up the area.

The fly situation became increasingly bad in July and both during the latter part of this month and in August the incidence of enteritis increased considerably.

Surgery and Medicine.—Very great credit is due to the surgeons, the majority of whom had little or no experience of war surgery. They one and all tackled their problems with the greatest enthusiasm and very soon acquired the status of "old hands."

Gastro-enteritis.—Typhoid and malaria were the major medical problems apart from those connected with surgical cases; e.g. the chest wound in which the onus for treatment after operation lay chiefly with the physicians.

Two interesting conditions are worthy of mention:—

- (i) The development during the hot summer months of a foot condition amongst tank crews in which the clinical signs consisted of pain, redness and œdema of either one or both ankles, combined with small hæmorrhages. Their interest lay in the severity of the condition after what must have been a comparatively short space of time in which crews were compelled to stand continuously in a confined and overheated space, the obvious cause of the condition.
- (ii) A case of perforating abdominal wound with severe multiple injuries caused by a missile not previously encountered. This consisted of a bullet of wood having an outer covering of metal. This incident occurred in the neighbourhood of Fontenay on July 2, and the extensive injuries must have been caused by the splintering.

ANNEXURE "A."

CASUALTY FIGURES FOR THE INVASION PERIOD.

June 6 to 10, 1944. Casualties amounted to 5,259. These were unclassified.

June 11 to July 1, 1944. 20,492 cases were admitted to medical units.

These were composed as follows:—

<i>Classification by type</i>	<i>Number</i>	<i>Average rate per 1,000 per week</i>	<i>Average rate as in (c) for 13 wks. ending Sept. 30, 1944</i>
(a)	(b)	(c)	(d)
Injuries, wounds, battle casualties	14,224	17.39	7.71
Injuries, wounds accidental ..	1,213	1.42	1.27
Injuries, wounds self-inflicted ..	52	0.06	0.05
Burns	331	0.39	0.23
Exhaustion	1,853	2.11	2.06

<i>Classification by type</i>	<i>Number</i>	<i>Average rate per 1,000 per week</i>	<i>Average rate as in (c) for 13 wks. ending Sept. 30, 1944</i>
(a)	(b)	(c)	(d)
Diseases of digestive system ..	565	0.21	1.25
Diseases of Respiratory system	397	0.16	0.48
Diseases of skin	591	0.27	0.76
Neurological diseases	88	0.10	0.17
IAT	585	0.63	0.72
PUO	593	0.65	0.56

In the first week exhaustion cases were 6.74 per cent of all cases admitted rising to 10.13 per cent in the second week and to 10.88 per cent in the third week.

EVACUATION FIGURES.

<i>Day</i>	<i>30 Corps</i>	<i>1 Corps</i>		<i>Total</i>
	<i>104 Beach Sub-Area</i>	<i>102 Beach Sub-Area</i>	<i>101 Beach Sub-Area</i>	
D	200	400	255	855
D + 1 ..	534	375	862	1,771
D + 2 ..	207	207	639	1,053
D + 3 ..	249	366	177	792
D + 4 ..	234	390	164	788
D + 5 ..	136	144	611	891
D + 6 ..	353	300	168	821
Totals	1,913	2,182	2,876	6,971

29 cases were evacuated by air on D + 7.

ANNEXURE "B."

PHASING IN OF SECOND ARMY TROOPS MEDICAL UNITS.

<i>D-Day</i>		<i>D + 4</i>	
Twelve	FDSs	One	FTU
Five	FTUs	Two	200-bed Gen Hosps
Nine	Surgical Teams	One	Det Mob Neuro Surg Unit
Four	Port Dets	Two	Fwd Distributing Secs BTU
Fifteen	FSUs		
<i>D + 1</i>		<i>D + 5</i>	
Five	FTUs	Two	Adv Blood Banks
<i>D + 2</i>		<i>D + 8</i>	
One	FTU	One	600-bed Gen Hosp
One	FDS	One	PAC (Class A)
One	FSU	Two	Port Dets
One	Fd Hyg Sec	One	Pl Amb Car Coy
		Two	FSUs
<i>D + 3</i>		<i>D + 9</i>	
One	CCS	One	FDS
Two	FSUs	Two	FSUs
One	Adv Depots Med Stores	One	Fd Hyg Sec
Two	Fd San Secs	One	Pl Amb Car Coy

D + 11
 One FTU
 Two 200-bed Gen Hosps
 One FSU
 Three PACs (Class B)
 Two Pls Amb Car Coy

D + 12
 Five FSUs
 Two PACs (Class B)
 Two Pls Amb Car Coy

D + 13
 One Mobile Dental Unit

D + 14
 Two Adv Depots Med Stores
 Two Port Dets

D + 16
 Three 600-bed Gen Hosps
 Two Pls Amb Car Coy

D + 17 — *D* + 22
 Eleven Mob DUs
 One Mob Neuro Surg Unit

D + 29
 One Base Depot Med Stores personnel (Stores arrived *D* + 22)

ANNEXURE "C."

CLASSIFICATION AND CAUSAL FACTORS OF TYPES OF WOUNDS (EXCL GERMAN P.O.W.)
 TREATED AT ONE CCS (BEACH FIGURES ARE FSUs).

		<i>Mortar</i>		<i>Shell</i>		<i>GSW</i>		<i>Bomb</i>		<i>Mine</i>		<i>Burns</i>	
		<i>Per</i>	<i>cent</i>	<i>Per</i>	<i>cent</i>	<i>Per</i>	<i>cent</i>	<i>Per</i>	<i>cent</i>	<i>Per</i>	<i>cent</i>	<i>Per</i>	<i>cent</i>
<i>Operation</i>	<i>Total</i>												
Beaches (FSUs) ..	73	36.5	15	7.5	66	32.0	13	6.5	27	13.5	8	4.0	
Operation JUPITER													
(Secqueville) ..	99	54.0	38	21.0	32	17.0	3	2.0	3	2.0	8	4.6	

ANNEXURE "D."

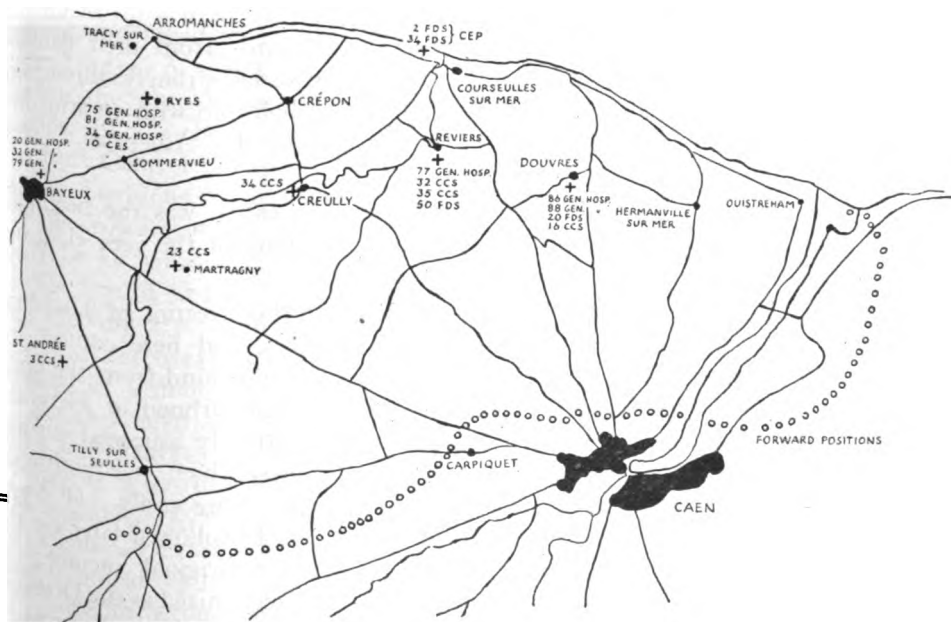
CLASSIFICATION OF WOUNDS.

(Admitted To Two CCSs During the Fighting in the Normandy Bridgehead.)

		<i>Total operated on</i>								
		<i>"A" CCS</i>			<i>"B" CCS</i>					
<i>Type of case</i>		<i>No.</i>	<i>% of total</i>	<i>Died</i>	<i>No.</i>	<i>% of total</i>	<i>Died</i>			
(a) SKULL	(i) Pent	8	0.60	2	6	0.69	2			
	(ii) Non Pent	26	2.00	—	—	—	—			
(b)	Maxillo Facial	30	2.30	1	10	1.14	2			
(c)	CHEST—Pent or Perf	102	8.00	9	70	7.98	8			
(d) ABDOMEN	(i) Perf	140	10.10	25	156	17.93	50			
	(ii) Non Perf	45	3.50	3	19	2.18	1			
(e)	ABDOMINO-THORACIC	29	2.20	14	33	3.79	17			
(f) AMPUTATIONS	(i) Above Elbow	10	0.65	1	12	1.38	1			
	(ii) Below Elbow	11	0.70	1	6	0.69	—			
	(iii) Above Knee	24	2.10	1	23	2.64	4			
	(iv) Below Knee	37	2.80	2	28	3.21	2			
(g) FRACTURES	(i) Spine with cord surgery	5	0.30	2	1	0.12	1			
	(ii) Spine without cord surgery	9	0.64	—	4	0.48	1			
	(iii) Pelvis	27	2.10	1	11	1.26	3			
	(iv) Femur	74	5.70	1	83	9.54	6			
	(v) Tibia and fibula	102	8.00	1	68	7.82	4			
	(vi) Humerus	62	4.10	4	35	4.02	3			
	(vii) Radius and ulna	45	3.50	—	22	2.52	—			

Type of case			Total operated on					
			"A" CCS			"B" CCS		
			No.	% of total	Died	No.	% of total	Died
(h) PENT WOUNDS—Joints								
(i) Shoulder	..	..	18	1.30	1	6	0.69	—
(ii) Elbow	..	..	15	1.20	—	2	0.23	—
(iii) Wrist	..	..	5	0.30	—	4	0.48	—
(iv) Hip	..	..	2	0.10	—	—	—	—
(v) Knee	..	..	36	2.80	—	21	2.41	1
(vi) Ankle	..	..	8	0.63	—	11	1.26	—
(i) BURNS								
(i) Serious	..	..	28	2.10	—	3	0.36	—
(ii) Slight	..	..	7	0.45	—	3	0.36	—
(j) FLESH WOUNDS (involving main nerves and main vessels)..	..	..	382	29.40	3	176	20.23	10
(k) GAS GANGRENE								
(i) Myositic	..	..	6	0.40	1	19	2.18	7
(ii) Cellulitic	..	..	1	0.10	—	2	0.23	1
(l) MISCELLANEOUS	..	..	—	—	—	36	4.14	1
Total			1,294		73	870		125
					(5.6% of total operated on)		(14.4% of total operated on)	

ANNEXURE "A" TO CHAPTER I.



CHAPTER II.

THE BREAKOUT FROM THE NORMANDY BRIDGEHEAD AND THE PURSUIT THROUGH FRANCE AND BELGIUM.

July 25 can be said to be the date when the general move forward really commenced. It was the date of the American attack southwards out of the Cherbourg Peninsula.

The British Break-out began with operation BLUECOAT on July 30, in which 8 and 30 Corps were engaged. Initially little progress was made by 30 Corps on the left, but 8 Corps after a rapid move to concentrate in the extreme western sector of the British Zone made considerable headway on the right. Now began the real test of past training in the rapid moving and setting up of medical units of all types to deal with the varying tactical situations.

The rapidity of the 8 Corps advance slowed down in the Estré-Vire area as they still had a very open left flank. The US forces were, however, making excellent progress on the right and as 30 Corps began to make headway on the left, capturing Mount Pincon feature on August 7 and Conde on August 16. the general position looked very grave for the enemy.

At the same time the advance on the left flank of Second Army was turning east and on the evening of August 6 an assault crossing of the River Orne north of Thury Harcourt was commenced by 12 Corps (59 Div). The enemy reacted strongly to this and put in heavy counter attacks.

Similarly on August 7 First Canadian Army commenced a thrust towards Falaise and 49 Division were also extending eastwards from their flanking position covering Caen. The enemy, however, resisted strongly throughout and on the American sector determined to make a bold bid with an armoured striking force (four Panzer Divisions) to cut the slender American L of C by closing the gap at Avranches.

The failure of this, very largely due to the air effort, was the beginning of the end for the enemy and along the southern flank of the very elongated pocket the US forces were making great strides.

On the 8 Corps Sector 3 (Br) Division attacked in the direction of Tinchbray also being approached from the south by US forces, and here contact was made with them. At the same time 30 Corps making ground from the north joined hands with the Ninth US Army in the neighbourhood of Flers and 8 Corps which had made the initial breakout was virtually squeezed out and its armoured Divisions passed to command 30 Corps which was positioned further to the east, and able to continue the advance more easily. 11 Armd Division passed to command of 30 Corps on August 14 followed later by the Gds Armd Division. 15 (S) Divisions, the other original member of 8 Corps, passed to 12 Corps and from now on became recognized as the Division which switched from one Corps to another and as it had done in the Normandy

bridgehead took part in every major engagement possible up to the finish of the campaign, a unique and wonderful record for its medical units.

The breakout had become a definite fact and the pursuit was on.

In the closing periods of this phase there were no major medical problems on the tactical side; casualties were not excessive and all forward medical units were well situated to continue easy evacuation to the medical area at Bayeux.

The next phase, which included the pursuit to and the crossing of the River Seine, went very rapidly; all formations closed in on the retreating enemy and pushed on as fast as possible. On August 16 American patrols had been reported as reaching the Seine but later withdrew; however by August 20 they had a force across the river in the Mantes-Gassicourt area.

On the north of Second Army 1 Corps was making good progress towards the mouth of the Seine and Lisieux was entered on August 22.

Second Army was advancing on a one Corps front and by August 21 11 Armd Division had occupied Gace, but further advance east of the road Couches-Verneins, the temporary boundary between First US Army and 21 Army Group, was delayed by agreement. At this stage contact between Canadian and the First US Armies was made on August 25 east of Bernay.

Meanwhile 12 Corps had come up on Second Army left and had troops on the line Bernay-Les Bottereaux. First Canadian Army was also approaching the Seine. The relief of the US forces which had been u/c 21 Army Group was now a possibility and 15 (S) Division was to advance on August 26 to Louvier to achieve this object.

8 Corps remained grounded for the time in the Vire-Flers area and contributed every possible item of transport to facilitate the advance of Second Army. During this period they studied all the problems of a major river crossing and based on earlier training in the UK, combined with the experience of the use of the latest types of amphibious craft, formulated a drill which became the standard model and later was successfully used for the Rhine assault. In this the disposition and use of all medical units required both by the Bank Control Group for the passage of the assault troops and those of the Assault Divisions themselves were very carefully considered.

The crossing of the Seine was effected in Area Vernon by 43 Division followed by 11 Armd Division and in the area Louviers by 15 (S) Division.

The feat of 43 Division in carrying out a long approach march of 90 miles and effecting a scramble crossing is particularly worthy of mention. Casualties were not heavy, but the medical units had their first experience of the crossing of a major river obstacle of considerable size.

For this rapid advance to the Seine the problems of the moves of medical units and their evacuation were by no means easy.

Bayeux was still the main Hospital Base and no ambulance trains were as yet available. Evacuation had perforce to be by road until in the last week in August air evacuation from Caillouet began. The road journey was long and to provide extra facilities for a shuttle service 227 MAC less 1 Pl was made available for Second Army by 8 Corps.

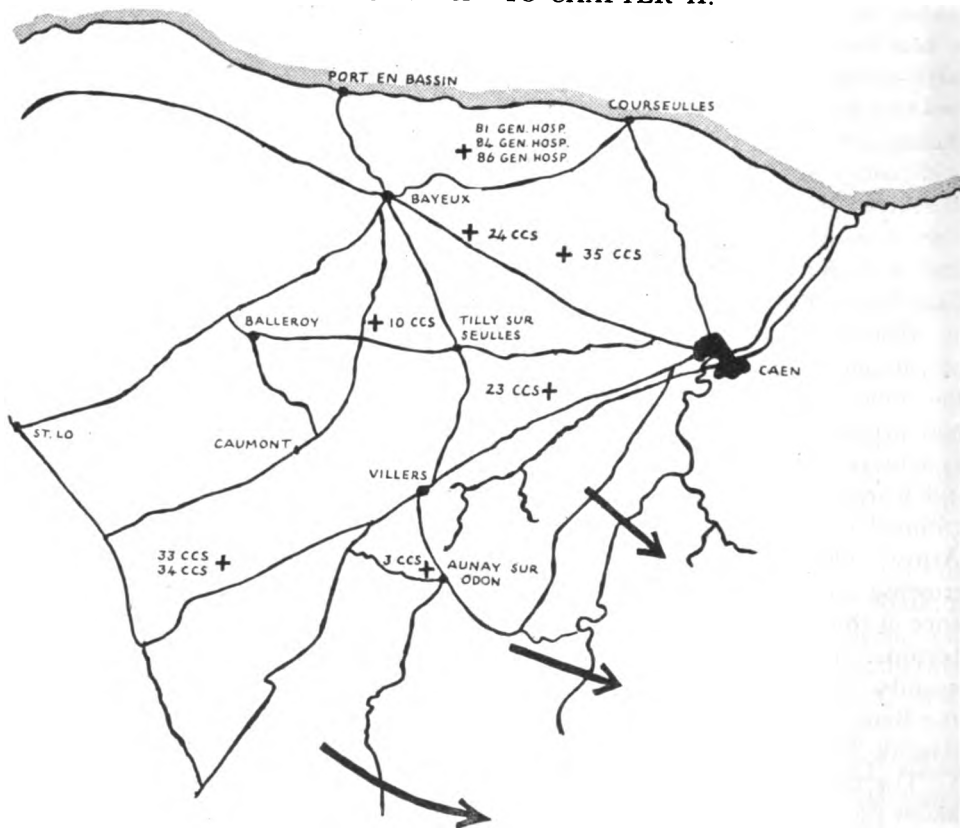
The moves of Corps medical units conformed with the advance.

30 Corps.

August 7: In the initial forward advance of 30 Corps before their actual breakdown a medical area was established just south of Villers Bocage at MR 823525. This was formed by 3 CCS with attached units.

A sketch map of the principal Medical locations at this time is attached at Annexure "A."

ANNEXURE "A" TO CHAPTER II.



August 18: The next medical area was established by 10 CCS and 3 FDS with FSU and FTU at 945245.

August 19: 3 CCS and 35 FDS closed and 21 FDS took over the non-transportal cases.

August 20: 3 CCS and 35 FDS opened at Montgaroult 185188.

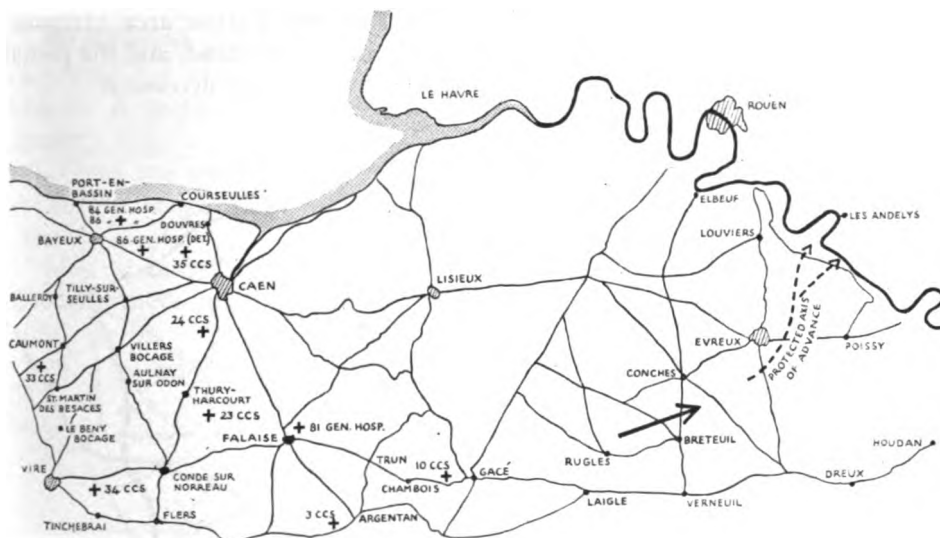
August 23: 10 CCS and 3 FDS (relieved by 49 FDS) moved to Gace 497455, and remained closed but later opened on August 26 at Caillouet 317655 (*vide* Annexure "B").

12 Corps.

August 6: 24 CCS was open in area St. Leger T 8675.

August 7: 23 CCS moving to area 906635.

ANNEXURE "B" TO CHAPTER II.



August 15: 24 CCS moved to Esrués 9953.

August 27: 24 CCS closed at Q920679, 9 FDS with 1 FSU open Q922678.

August 28: 23 CCS opening at area R178871 and to be joined by 4 FDS with two FSUs and one FTU on August 29.

Army Med Units.

August 24: 81 Gen Hosp moved to Aubigny Q1338 (N. of Falaise) (approx.).

Position 86 Gen Hosp open for local sick at Rugles Q8548

August 31: 84 Gen Hosp open for wounded and as air evacuation Hospital at Caillouet R317655.

Evacuation at this stage was still to Bayeux by air from Caillouet and by road from Rugles staging at Aubigny if necessary.

At this stage 35 CCS was closed in Evreux area R2267 ready to move forward as air evac cushion, a role it filled continuously until the end of the campaign.

The sketch map at Annexure "C" explains the lay-out of medical units at this stage of operations.

SUMMARY.

Up to this stage no further problems had occurred needing comment. The rapid opening and closing of units had become a drill with which all were soon conversant. The only difficult problem was the moving of Depots of Medical Stores to conform with the pace of the advance. A mobile element comprising two three-ton lorries was attached to each Advance Depot Medical Stores for the supply of equipment to medical units in Divisional and Corps areas.

This advance was the first to occasion when German hospitals were overrun and any large quantity of medical equipment captured.

A hygiene problem arose from the large number of German dead and the innumerable carcasses of horses and cattle left in the Falaise area. In some instances resort had to be made to mass burial of German dead, and the partial cremation of animal carcasses before burial was rendered necessary.

ANNEXURE "C" TO CHAPTER II.



Pursuit into Belgium.

The pursuit of the retreating enemy now became a rout and calls for little comment. The difficulty of moving Corps and Army medical units to keep pace with the advance was offset by the very few casualties that occurred, and the possibility of using Belgian civilian hospitals for the reception of casualties in forward areas.

11 Armd Div crossed the Seine on the night August 28/29 and Guards Armd Div August 30.

On August 31 leading elements of 11 Armd Div reached the outskirts of Amiens while Gds Armd Div by-passed it to the SE and captured the Corbie Br intact and by night August 31 was astride the road from Amiens to Albert.

Progress was equally rapid during the next two days whilst 12 Corps was also forging ahead on the left in an attempt to catch up.

Douai was captured by the Guards on the afternoon of September 2 and orders were issued for the move into Belgium on September 3. Guards Armd

Div directed on Brussels and 11 Armd Div on Antwerp. By this time 12 Corps Tps had reached the area St. Pol.

By the night of September 3, Guards Armd Div had reached Brussels and early next day were pushing on to Louvain. 11 Armd Div after a temporary hold up at Seclin had elements in Audenarde and on September 4 entered Antwerp.

12 Corps was meanwhile advancing more slowly through the difficult country the north directed on Ghent and eventually relieved 30 Corps in Alost-Antwerp area.

Medical units had little chance to open during the period of this chase through France and Belgium but the following are the main locations at which units opened.

30 Corps.

- September 2: 3 CCS. Opened area Allonville 1664.
- September 4: 10 CCS. Only opened once between their last location and Fresnoy 5707 (NW of Douai).
- September 6: 3 CCS. Opened at Asche J5263.

12 Corps.

- September 1: 9 FDS (with 2 FSUs and 1 FTU) open Bouricourt M641210.
- September 3: Position same. Both CCSs closed ready to move fwd.
- September 4: 23 FDS with 2 FSUs and 1 FTU open Heide 149943.
- September 5: 23 CCS and 4 FDS with 1 FTU open area Noeux Les Mines 405225.
- September 7: 4 FDS with 2 FSUs and 1 FTU open at Oombergen 265626.
- September 12: 24 CCS open with 1 FTU at Mechlin 709773.
23 CCS closed with 1 FTU at Mechlin 709773.
9 FDS open at Mechlin 709773.

Army Medical Units.

- September 4: 81 Gen Hosp (200 beds) opened in the Asylum des Aliennes Amiens shortly followed by 25 Gen Hosp (600 beds).
- September 6: 86 Gen Hosp Adv Party in Brussels (Hosp St Pierre) where a German Mil Hosp was overrun. 70 British wounded from the advance were found and all had been well looked after by the German surgeon.
- September 7: 84 Gen Hosp (200 beds) closing at Caillouet and moving to Brussels (hosp Brugman).
35 CCS closed at Amiens and moving to Antwerp.
- September 9: 86 Gen Hosp (200 beds) open, shortly to be relieved by 8 (Br) Gen Hosp (600 beds).
- 9 (Br) Gen Hosp was moved to Rouen early in the month.

Evacuation.

Air evacuation commenced on September 5 from Glisy near Amiens and from Brussels on September 7. There was some difficulty at the latter airfield during the next two days as Dakotas arrived without the necessary fittings.

Whilst this phase was proceeding 8 Corps remained grounded and supplied all possible transport both medical and otherwise for the support of Second Army.

During this period commenced one of the most interesting professional problems of the whole campaign—an outbreak of typhoid which was in the HQ Sqn of the 6 Guards Arm'd Bde.

Here it will suffice to give a brief outline.

On September 10 six patients were admitted to 110 Gen Hosp Bayeux suffering from enteric fever; they had been sent on from a CCS with a request that Widal tests should be carried out as the possibility of this diagnosis had been recognized amongst some twenty-odd cases admitted between September 2 and September 8 from a forward medical unit with the label influenza. Other suspicious cases were found and it was soon recognized that an epidemic of a serious nature was occurring in one unit—the HQ Sqn of 6 Gds Tk Bde. The numbers and statistics are given in the detailed report but it is worthy of note that with one exception the whole unit was completely protected by inoculation. Despite this the percentage of death was high, and the infection must have been of considerable virulence.

Immediate and very full investigations were carried out but despite this no definite source of infection was ever confirmed. A Mobile Bact Lab was attached to the unit for a considerable period and every avenue was investigated. It was significant that no officer was infected and that it was confined to members of the unit and two ORs who visited the unit and had a meal in the unit cookhouse.

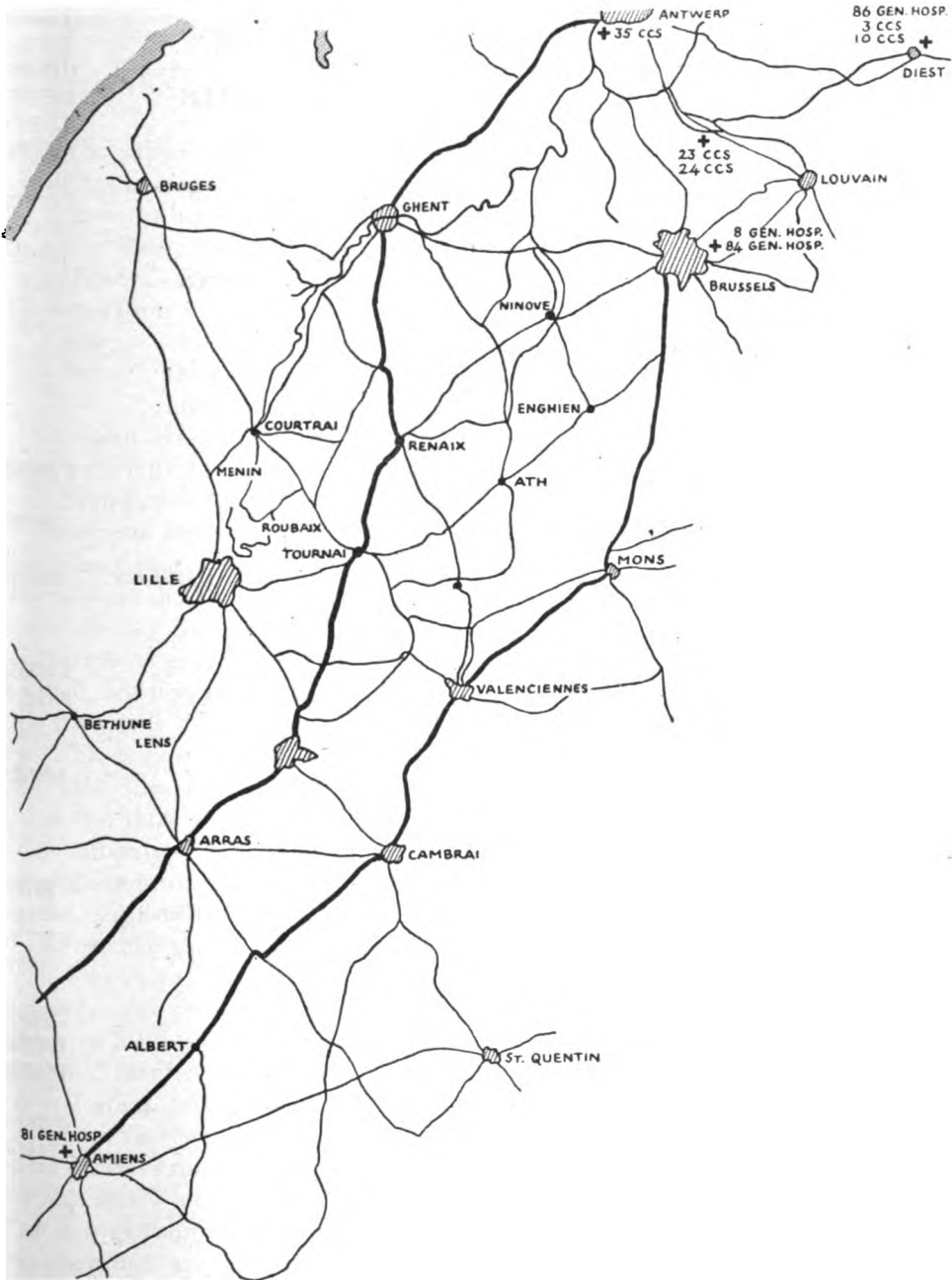
Apart from this interesting problem there was nothing of note to record during this period.

LOCATIONS AS ON SEPTEMBER 11.
(*vide* Annexure D.)

Brit Gen Hosps

8	Second Army with Maxillo-facial and Neuro-surgical teams)		
		Hosp St. Pierre, BRUSSELS	J613538
81	Second Army	Asylum des Aliennes AMIENS	N084554
84	Second Army	Hosp Brugmann BRUSSELS	J605596
86	Second Army	DIEST	K158712
<i>CCSs</i>			
3	30 Corps	DIEST (closed)	K113680
10	30 Corps	DIEST	K158712
23	12 Corps	area MALINES (closed)	J709773
24	12 Corps	area MALINES	J709773
33	8 Corps	ST JEAN DE FRENELLE	R458957
34	8 Corps	ST JEAN DE FRENELLE	R458957
35	Second Army	Colonial University ANTWERP	J6794

ANNEXURE "D" TO CHAPTER II.



FDSs

1	8 Corps	LILLE	H6836
2	Second Army	Asylum des Aliennes AMIENS	N084554
3	30 Corps	DIEST	K158712
4	12 Corps	OOMBERGEN	J265626
9	12 Corps	(closed)	J7177
21	Second Army (temp L of C)	AUBIGNY	U130382
24	8 Corps	ST JEAN DE FRENELLE	R458957
25	First Cdn Army	DIEPPE	M223674
31	Second Army	ST VICTOR AMIENS	N113590
32	Second Army (temp L of C)		
35	30 Corps	DIEST	K113680
47	Second Army	RENAIX	J0747
49	Second Army	Mil Hosp BRUSSELS	J609520
50	Second Army	75 Rue Brussels ENGHJEN	J3939

Blood Distribution

1 Blood Bank	Second Army	with 8 Brit Gen Hosp
1 Fwd Truck	12 Corps	with 24 CCS
2 Fwd Truck	30 Corps	with 10 CCS

Adv Depots Med Stores

8	Second Army	AUBIGNY	U130382
		moving to BRUSSELS	
9	Second Army		N1563
Mob elt		with 10 CCS	
11	Second Army	L'Hopital Brugmann, BRUSSELS	J605596
Mob elt		in reserve	

MACs and Amb Car Coy

111 MAC	30 Corps	DIEST	K113680
227 MAC	8 Corps	ST JEAN DE FRENELLES	R458957
302 MAC	12 Corps		J7177
257 Amb Car Coy	Second Army	BREEDHOUT	J507469

L OF C MEDICAL UNITS**Brit Gen Hosps**

9		L'Hotel Dieu ROUEN	M1815
25		Asylum des Aliennes AMIENS	N084554
32 (for Psychiatric cases)		BAYEUX	T772792
73 (for VD cases requiring hosp)			T7778
77 (for special Max-fac and Neuro Surg case)		REVIERS	T960818
79 (for special Chest surg cases)		BAYEUX area	T768787
110 (SI wounds)		BAYEUX area	T757783
Base Depots Med Stores			
5		BAYEUX area	T770790
12			T744788

(To be continued.)

MEDICAL PLANNING.¹

BY

Brigadier R. D. CAMERON O.B.E., M.C.

Royal Army Medical Corps.

PART I.

(1) The subject of this lecture is *Medical Planning*, with special reference to problems of large-scale operations.

I propose to begin by discussing Medical Planning in general, and to follow this up by illustrations from specific operations.

(2) *Object*.—The object is to plan the whole of the medical arrangements of the operation so that:—

first: the fighting fitness of the force is maintained,

second: the casualties (sick and wounded) are collected, removed, treated and returned to duty as soon as possible.

Expressed otherwise, the role of the medical services is to conserve man-power, especially *trained* man-power. The reasons for this are obvious.

(3) Man-power is lost from two causes: (a) Disease, (b) Enemy action.

I have put them in that order deliberately to stress the fact that there is more man-power wastage from disease than from enemy action. "The mosquito is more deadly than the mortar." The ever-loving wife who bids a fond farewell to her husband, when he sets forth for battle, retires disconsolate to her quarters to pray to her Gods that her man be spared from the enemy's shot and shell, but it would be more appropriate for her to pray that he be preserved from the perils of pestilence which, in actual fact, is more likely to lay him low. This is particularly true in tropical and subtropical countries. In India, battle casualties in the earlier years of the recent war were less than 1 per cent of the total admissions to hospital—actually 1 in 120—and at the height of the campaign they never exceeded 10 per cent. Even in Europe, with its comparative immunity from disease, less than half (actually 45 per cent) of all hospital admissions during the campaign were battle casualties.

Let us take these in turn:—

(a) *To conserve man-power from disease*, it is the duty of the medical service to recommend measures for the prevention of disease, so as to reduce its incidence to a minimum. These measures are the adoption of the principles of preventive medicine together with insistence on a high standard of hygiene and sanitation. Attention to this will reap a rich dividend. In the Walcheren Expedition two centuries ago the whole British Force was wiped out by disease before it even came to battle. In the Walcheren Expedition of 1945, the battle was won and Walcheren was in our hands before disease came into the picture.

It is important to remember that for every one man who goes sick, at least two more men are required, viz. one to replace him and one or more to treat and transport him. Consequently, anything we can do to reduce the incidence

¹ A lecture delivered at the Staff College, Quetta, on November 28, 1946.

of sickness means a tremendous saving in man-power—and further a saving in buildings, tentage, medical equipment and transportation by land, sea and air.

The records of what was accomplished in the later stages of the war in South East Asia show what can be achieved in the way of preventive medicine.

(b) *To conserve man-power from enemy action*, the medical services can do little in the way of prevention, so they must be prepared to deal with the results of it, i.e. they must retrieve the casualties as quickly as possible and do their best for them for all of the following reasons:

- (i) casualties must not be allowed to clog the fighting machine;
- (ii) the presence of uncared-for wounded affects the morale of the unwounded;
- (iii) ordinary humanity demands it;
- (iv) man-power must be maintained by getting wounded fit to fight again.

Whilst we must clear fighting units of encumbrances we must not evacuate to the Base cases that can be treated in forward areas. A system of sorting out or triage should be adopted, devised towards conservation of man-power. Thus minor sickness and exhaustion can well be treated in divisional medical units even to some degree when the Division is in action. Even more can be treated in Corps units, where often it may be advisable to form a Corps Medical Centre, but there will always remain a proportion of long-term cases, mostly wounded, who are best evacuated to the Base, and of these a percentage should go overseas. (In Europe 36 per cent were transferred to the U.K.) The percentage will depend on the nature of the operations and of the facilities for treatment in the L. of C. and Base. In slack times it is justifiable and desirable to hold cases; when operations are imminent, administrative medical officers will ensure that the "decks are cleared." There is an exception to this—V.D. cases and exhaustion cases should not normally be given a free trip to Base. Regard these as temporarily knocked out; send them off the field of play, but keep them on the side-line and get them back into action as soon as they get their wind back.

(4) All above has a bearing on medical planning since we must always keep our Object in mind. Before I go further, it may be well to define the relations and responsibilities between administrative medical officers on the one hand and the Commander and his Staff on the other. These are:—

- (a) The administrative medical officer, from the Director of Medical Services downwards to the Regimental Medical Officer, is the adviser of his Commander (to whom incidentally he has direct access) on all matters affecting the health and fitness of the troops. He is responsible for the organization, disposition and control of the Medical Services, to the "A" Branch of the Staff who co-ordinate all matters of general policy in consultation with other branches of the Staff as may be necessary.
- (b) To implement the policy approved by the "A" Branch of the Staff, the medical services deal direct with the General Staff, the "Q" Branch of the Staff, and the Services on detailed matters of provision, movement and accommodation of medical units.

(5) The medical officer concerned with planning should bear these principles in mind lest he wastes his time in formulating plans which are not acceptable to the Staff of his formation. He must realize that his plans *must* fit in with the main plan. He may, for example, think it desirable to put a medical unit ashore in an assault by a certain hour, but if, owing to shortage of shipping, the Staff rule that anti-tank guns take priority, he must accept that ruling. After all, the main object of the operation is to defeat the enemy—the care of wounded, though essential, is secondary.

(6) Having now established that the administrative medical officer must conform to the general plan and, if necessary, subordinate his interests to the requirements of the Staff, and that he must obtain the approval of the "A" Staff for his plans, let us turn to the other side of the picture. It is the right of the medical administrative officer to be kept fully in the picture as regards the plan and the development of the plan; in other words he must be taken into the full confidence of the Staff. It has always been my experience that this has been done. I mention it merely because I have been told of instances where it has not been done. To get back to basic principles, it is simply a question of Common Sense, Co-operation and Co-ordination.

(7) Let us now consider Medical Planning. I have already given the object, viz. the conservation of man-power.

Let us examine the medical factors. While these are many and varied they can be grouped into two main headings, viz.:

- (a) the type of operation, e.g. assault landing, set-piece battle, dog fight, break through, river crossing, etc.;
- (b) the nature of the terrain, e.g. desert, jungle, mountain or plain; tropical, subtropical or temperate country, with their attendant diseases and epidemics.

Having studied (a) and (b), it will be possible to arrive at an estimate of the numbers of wounded and sick and to plan accordingly for their disposal, and determine:—

- (i) policy as to retention in the theatre, or evacuation beyond it;
- (ii) percentage scale of bed cover required, the proportion of these required in advance Base, in L. of C., in main Base or behind Base, i.e. overseas; beds required for Ps.o.W. and in certain circumstances for civilians;
- (iii) methods of transportation, e.g. on land—jeeps, ambulance cars and trains; on water—ships and river craft; in the air—type of aircraft; in amphibious operations—weasels, buffaloes, DUKWs; linking up the various methods of transportation, e.g. loading parties on beaches, on river crossings, on airfields;
- (iv) provision of medical units, including specialized ones; provision of medical and nursing personnel, including specialists;
- (v) provision, distribution and maintenance of medical stores, including specialist stores, such as blood, plasma, sera;
- (vi) advice on preventive hygiene, including water purification, inoculation, special clothing and equipment, methods of sanitation. *Note:—*This, though placed last, is by no means least. Adoption of the principles

and practice of preventive medicines is the biggest factor in the preservation of man-power.

(8) There are thus several problems, but we are assisted in their solution by the standard Order of Battle which gives a definite allotment of medical units to a Division or a Corps, all of which are known or can be readily looked up. What is not definitely laid down is the scale of medical units behind a Corps. Based on the appreciation, the scale and type of medical unit has to be firmed up for each particular type of operation, dependent on expectation of disease and casualties.

For example the provision of Base bed cover varied from 3 per cent in Europe to 10 per cent in South East Asia.

(9) When it comes to the actual planning of a definite operation, the task of the administrative medical officer is not really difficult. He is given a copy of the G.S. appreciation and outline plan, followed by the "A" appreciation. He will be expected to provide a medical section for the "A" outline plan with a view to this appearing in either the Outline Administrative Instructions or the Maintenance Project, depending on the level. To prepare this he must make a careful appreciation of all the factors enumerated above. When making his appreciation he should approach the subject in a logical textbook order, lest he overlook any points.

He will then be in a position to formulate his outline plan for submission to, and the concurrence of, "A."

Throughout the whole period of planning—outline planning, main planning and detailed planning—he must keep in constant touch with "A" Staff. He attends the Commander's conferences and the "A" and "G" conferences; in matters of detail he deals directly with the other Services. He must keep in touch with his opposite numbers in Navy and Air Force if they are involved—and one or other or both generally are.

In arriving at his final plan he must ensure against emergencies which may, and generally do, arise.

(10) In any major operation it will almost certainly be necessary to arrange special training for medical units involved. This training will, of course, be going on throughout the planning period.

(11) Finally, having agreed his plan with "A," it will be incorporated in Administrative Instructions or their equivalent issued by "A." There remains, however, the necessity of putting across the details to his own service. For a major operation he can do this in a Medical Operational Instruction which he should issue through Service channels to subordinate medical administrative officers and medical units (with copies to all concerned), reinforced by constant conferences, to ensure that everybody knows his task.

In smaller operations, it is no longer necessary or customary to issue Medical Operational Instructions—these are replaced by Conferences, at which again the administrative medical officer will issue clear instructions verbally and be prepared to answer questions.

Subsequently he should call a conference of administrative medical officers of lower formations and get them to expound their plans in the presence of

each other. This ensures lateral liaison which is nearly as important as vertical liaison.

(12) These then are the main principles of medical planning and, rather than go into details, I think it will be more profitable to give an account of the medical aspect of certain specific operations.

PART II.

(13) We will take operation OVERLORD, viz. the assault on Europe, and deal briefly with the medical problems and planning for three phases of that campaign, viz.:—

- (i) An opposed landing, i.e. the initial assault.
- (ii) A set-piece battle, i.e. clearance of the Reichswald.
- (iii) A river crossing, i.e. passage over the Rhine.

(14) In the assault landing, obviously the major medical problem was the disposal of casualties. After much consideration the following policy was agreed upon and laid down:—

- (a) Non-transportable casualties, i.e. those too seriously wounded to stand movement would be retained in the beach head and life-saving surgery would be provided for them.
- (b) All transportable casualties after preliminary treatment would be evacuated forthwith out of the theatre of operations, to hospitals in U.K.

(15) How was the policy to be implemented?

(a) Was easy. Suitable units exist, viz. the field Dressing Station, the Field Surgical Unit and the Field Transfusion Unit. These three units when functioning together form an Advanced Surgical Centre, fully equipped to provide Resuscitation and major Surgery. One such Surgical Centre exists as part of the normal composition of a British Beach Group. As you know there is one Beach Group allotted for each assault Brigade. In this particular operation it was decided to double the surgical potential and consequently for each assault Brigade Group there were two of the above Surgical Centres, and the only problem that remained was to ensure that they were bid in early in the landing tables—this was done.

(b) The second problem was not so easy, in fact until solved it was a source of considerable anxiety. Hospital ships and hospital carriers existed, but there was no satisfactory method of loading them *except in port*. At sea, where they must necessarily be in an assault landing, there was no method of transferring casualties to them in bulk. Consequently, it was clear that some other method of sea transportation was required to deal with the hundreds of casualties to be expected in an assault on Fortress Europe. At this juncture (in 1943), the DUKW put in an appearance—an amphibian godsend. Here was a six-wheeled vehicle capable of running on land or in water, capable of carrying up to 25 wounded with comfort, including 10 stretcher cases, from inland right out to sea. But the problem still remained how and where to embark them at sea. The answer was provided by the L.S.T. (Landing Ship Tank). This remarkable

sea-going vessel, as you know, has got a truly enormous hold, primarily designed for the carriage of tanks, with a wide ramp at the bow, which it lays down for loading or offloading purposes.

Once the L.S.T. has discharged its cargo it presents a picture of a ship with a vast hold, large enough to accommodate 300 stretcher cases, with a loading ramp laid down in the most inviting manner for vehicles to enter. It was at once obvious that if we could drive DUKWs bodily into the belly of the ship, the problem would be solved. Trials were held over three years ago. DUKWs were loaded on the beach and driven into an L.S.T. lying at anchor two miles out at sea, in a moderate swell. No difficulty was experienced in getting over the ramp; once inside these DUKWs offloaded their passengers and had the choice of backing out or turning round, for although the DUKW is over 33 ft. long, the hold of the L.S.T. is so wide that the DUKW can turn round inside it. The problem of embarkation of casualties at sea was thus solved by a combination of DUKWs and L.S.T.—a happy, heartening and completely satisfactory solution.

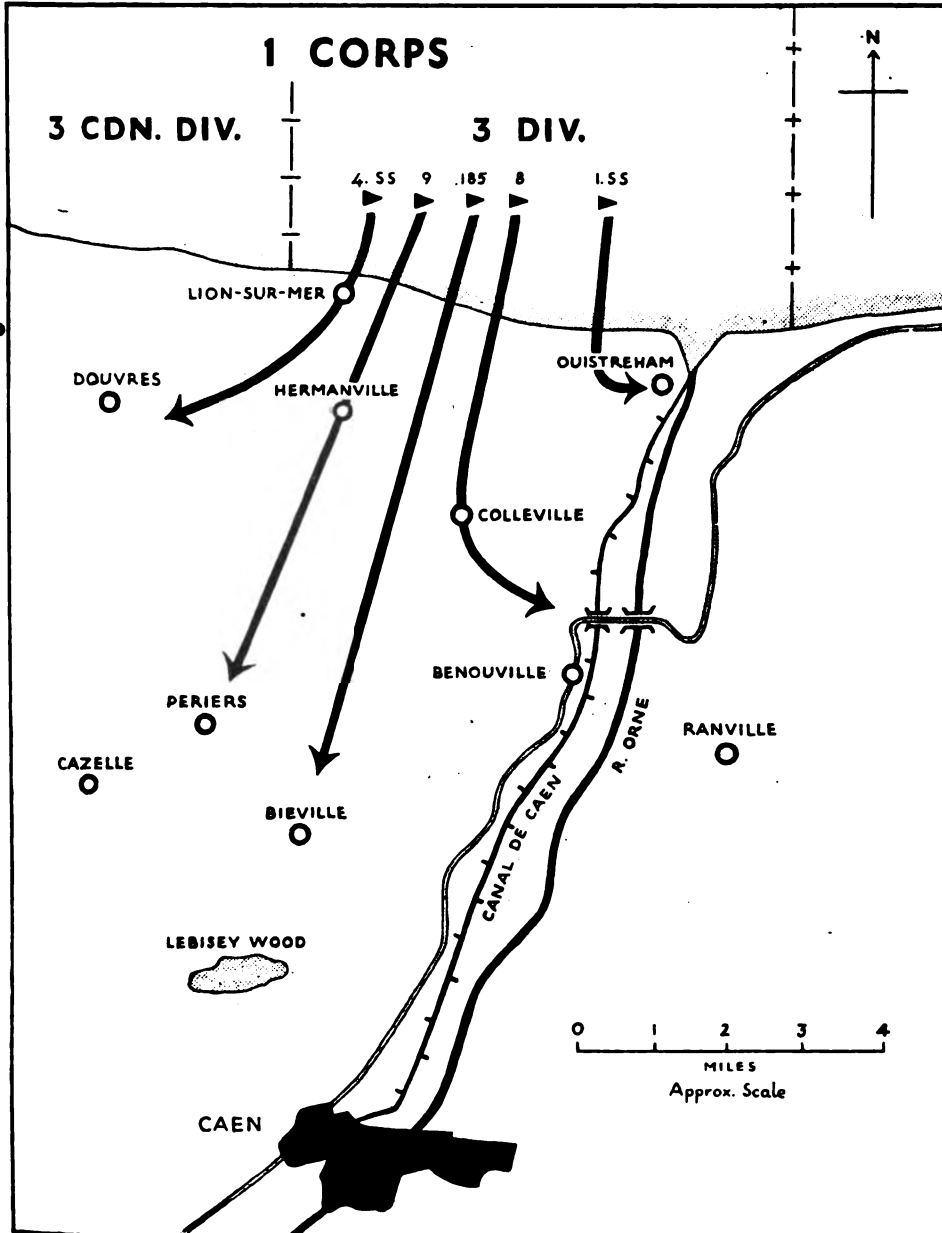
All that remained was to supply a loading ramp for the DUKWs and to fit up the L.S.T. with stretcher fittings and a surgery.

The poor old hospital carrier was outmoded and placed on the super-numerary list. Prior to the arrival of the L.S.T., plans were afoot to knock a waterway right through her innards, to enable the DUKW to penetrate her body and offload casualties, but she was saved this indignity.

(16) The next problem was the *collection* of casualties in the landing and on the beaches. We can divide this into three phases:—

- (a) The collection of casualties at sea. The Navy are responsible for these up to the point the assault craft touches down. It was arranged that casualties occurring in assault craft should remain in them and be returned to the parent L.S.I. (Landing Ships Infantry) where medical attention was available. For casualties occurring in the water after the troops had left the craft, the plan was that they were to be assisted ashore above high-water mark and left for the attention of the Beach Dressing Stations (*see* below).
- (b) It was obvious that there would be very heavy shelling of the beaches during and after the assault landing. Whilst of course units had their regimental medical establishments with them, and were closely followed by Field Ambulances, it was decided not to commit either on the beach, lest they be immobilized and unable to keep up with the assault inland. Accordingly a separate medical establishment was devised for the beaches. This consisted of Beach Dressing Stations of which four per Division (two per assault Brigade) were allotted. The personnel was found from the Field Dressing Stations of the Beach Sub-Area, and they were reinforced by the regimental medical establishment of the units of the Beach Group, viz. M.O.s of A.A. Rgts, R.E., etc. These were to establish Beach Dressing Stations a couple of hundred yards or so from the shore to afford first aid to casualties occurring in the Beach Area up to two miles inland. For the collection

ASSAULT AND OPERATIONS ON D-DAY OF 3 DIV.

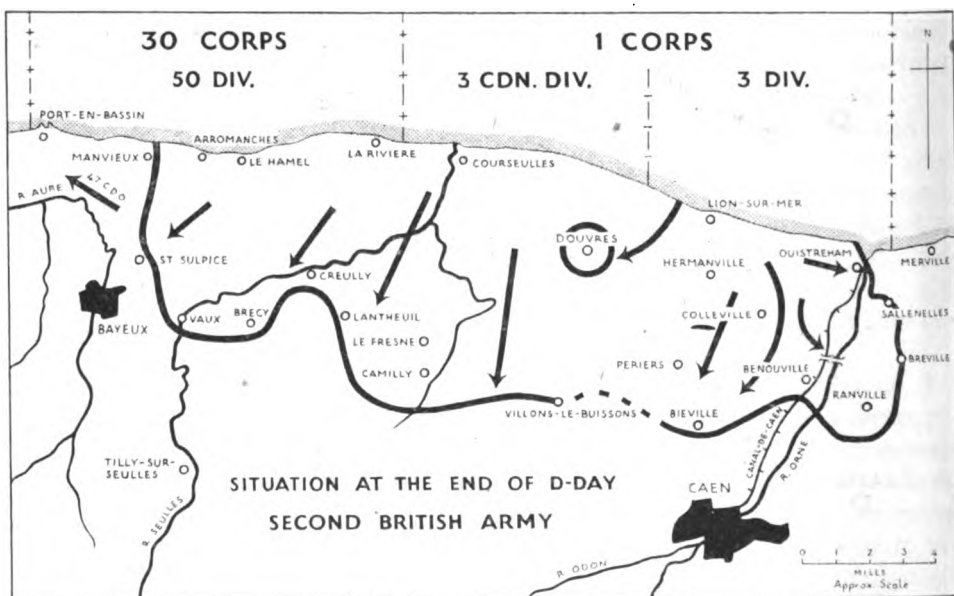


of these casualties two companies of Pioneers were allotted per Assault Division equipped with stretchers.

- (c) Inland the Field Ambulances were to function with their Brigades in the ordinary manner, viz. form C.C.P.s and A.D.S.s. To maintain liaison, it was arranged that a small detachment of each Field Ambulance landed with the R.A.P. of each assault Battalion and accompanied it until the R.A.P. was set up.

(17) These arrangements thus catered for the troops normally found in a Division, with the added component of two Beach Groups. But in this particular Division there were two additional commitments, viz.:

- (a) collection of casualties from two Commando Brigades, one on each flank, and



- (b) the evacuation of the casualties of the Airborne Division operating on the left flank of the Orne.

As regards (a), arrangements were made to collect the wounded by hand carriage and stretcher jeeps into the Beach Dressing Stations.

As regards (b), a rendezvous was fixed at a point on the far side of the Benouville Bridge, where an officer of the Assault Brigade Field Ambulance was to meet a medical representative from the Airborne Division to give the location of the latter's A.D.S.s, so that arrangements could be made for taking over the casualties and evacuating them by ambulance jeeps. To this end, the Divisional Field Ambulance officer nominated for the job was sent to live with the Airborne Field Ambulance concerned in the U.K. for a week prior to the assault to get to know the officers, and conversely an officer of the Airborne medical staff landed with the Assault Field Ambulance as liaison Officer. In this connexion it is well to remember that it will always be the

responsibility of the nearest ground formation to make contact with and evacuate the casualties of Airborne troops until such time as their ground "tail" reaches them.

(18) It was next necessary to make arrangements for despatching casualties from shore to ship. For this a Casualty Evacuation Point (C.E.P.) was to be established. The personnel for this was found from a Corps F.D.S. and consisted of two officers and 40 Other Ranks, including clerks and stretcher-bearers, to load the DUKWs, reinforced by Pioneers. You may wonder "why Clerks?" They are essential to keep a record of casualties. In actual fact a new book was designed holding triplicate tear-out pages each of a different colour. As each casualty was put in a DUKW, a clerk entered his particulars in this book from his tally-card; two copies accompanied the casualty to England; the third copy was retained and transferred to a nominal roll which was sent at six-hourly intervals to 2nd Echelon. This meant that we had a complete record of any casualty who left the theatre, and that 2nd Echelon could quickly inform his next of kin.

(19) To tie up all the medical arrangements on the beach a D.A.D.M.S. Embarkation is borne on the strength of the Beach Sub Area. Shortly before embarkation it was agreed that the A.D.M.S. of each assault Division should have one naval liaison officer attached, who working under the S.N.O.L. (Senior Naval Officer of the Landing) should control the movements of the L.S.T. allotted for casualties.

(20) Next a word on equipment under two headings:—

(a) modifications.

(b) replenishment.

(a) There were many modifications but I will only refer to two major ones, viz. the addition of ten ambulance jeeps per Field ambulance of the assault Division. These are ordinary jeeps fitted to take three stretchers and proved invaluable. They will go places where a four-wheel drive light ambulance car will get bogged. The other modification was the issue of light Airborne stretchers to Regimental Stretcher Bearers. These stretchers were a great success for the initial stages but they were not strong enough to last out the campaign.

(b) Replenishments—every medical officer and R.A.M.C. Other Rank brought in dressings in his pack, all medical vehicles including the medical DUKWs were preloaded with medical stores, stretchers and blankets; arrangements were made for the supply on D + 1 onwards of pre-assembled bricks of medical stores and of stretchers and blankets to be delivered to the O.B.D. (Ordnance Beach Detachment) in the Beach Group, to which two R.A.M.C. serjeants were attached. Blood and plasma were brought in two blood wagons fitted with a refrigerator; replenishment was by a daily launch from England. Every vehicle in the assault carried six shell dressings and one stretcher and blanket; every man was trained in elementary first aid.

(21) Detailed planning started in February 1944. This involves laborious and continuous work for all concerned; co-operation and co-ordination are essential, since so many interests are involved. Bidding begins for times and space, bids are pruned down to the lift available, priorities are settled and finally

the landing tables are agreed and completed; ship and unit lists are compiled, first for the assault and next for the build-up.

(22) Concurrent with planning, training must go on, and Exercises held at every level, finishing up with one or more rehearsals, made as near full dress as possible. This means close association with the Navy; in our case we lived, planned and worked with our naval component for six months before D-Day.

(23) The medical plans subsequent to the landing were gradually to build up C.C.S.s in the beach-head and hospitals in the maintenance area. To this end the first C.C.S. was bid in on D + 1, the first hospital on D + 2; evacuation by DUKW and L.S.T. was to continue until the Mulberry was complete, when hospital ships could load from it; air evacuation was to start as soon as an airfield was available. Nursing Sisters were to come in after the first week, and in fact did so.

(24) So much for the planning, and now let us see what happened, say on one divisional front. The assault troops of 3 Division having overcome the opposition on the beaches got roughly 5 miles inland on D-Day, and occupied a position approximately from Gazelle to Benouville; on the left flank the bridges over the Orne river and canal were secured complete by the Airborne Division and Ranville was held by them. The Commandos took the port of Ouistreham but there was stiff resistance on the right flank, so that we did not link up with the 3 Canadian Division for two days; there was in fact an enemy strong-point at Douvres which held out for over a week.

(25) The medical arrangements worked well. The first Beach Dressing Station was set up at H + 60 mins., the remainder shortly afterwards. The first Advanced Surgical Centre reached the exact spot chosen on the first key plan by 1200 hours, i.e. H + 4½ hours and began to function by H + 5 hours; the second Surgical Centre joined the first, since its allotted location was still in enemy hands when it landed. The other two followed on the second tide and it was decided to amalgamate the surgical resources into one Composite Centre, which turned out to be a very satisfactory arrangement.

Each Field Ambulance opened C.C.P.s for its Brigade. In addition H.Q. of the Field Ambulances of the leading Brigades opened A.D.S.s at Colleville and Hermaville in that order. H.Q. of the third Infantry Brigade Field Ambulance remained in reserve; H.Q. of the Armoured Brigade Field Ambulance was not brought in until several days after the landing. The assault Brigade Field Ambulance made contact with the Airborne Division in the late afternoon of D-Day the Airborne Field Ambulances, reinforced by surgeons, dropped with these troops and were functioning freely by the time contact was established.

By evening the first L.S.T. had been offloaded and was standing empty out at sea, ready to receive casualties; the first 12 DUKWs had arrived on the first tide (carrying a reserve of 4,000 stretchers) and were lined up loaded with wounded; they set forth at 1830 hours and filled the first L.S.T. She sailed with a full complement of wounded at 2000 hours and delivered her human cargo to the hards in England within twenty-four hours of their being hit (and many of these were back in two months). During the succeeding twenty-four hours, 1,740 casualties from 3 Division and 6 Airborne Division were cleared by

DUKWs and L.S.T.s to U.K. Approximately 400 who were too severely wounded for transportation were retained and looked after in the Surgical Centres. Evacuation continued without interruption. It was an inspiring sight to see the ambulance jeeps proceeding in a constant stream from the forward C.C.P.s and A.D.S.s either to the Surgical Centre or to the C.E.P., and to see the trickle of DUKWs steadily loading their cases into the receptive L.S.T.s. One could justly use that hackneyed expression and say with truth "medical evacuation proceeded according to plan."

So much for the assault landing.

(26) We will now consider briefly the medical arrangements for a set piece battle, viz. the Battle of the Rhineland, i.e. Operation VERITABLE for the British and Canadian Army, Operation GRENADE for the American Army. At the commencement of the battle, the Allied forces were disposed along the line River Roer—River Meuse, Mook to Nijmegen—River Wall, with the Americans on the right south of Roermond, the British in the centre, and the Canadians on the left. The object was to clear the German forces out of the territory they held west of the Rhine and so prepare the way for the crossing of the Rhine. This battle had been planned to take place in January 1945, but Von Rundstedt's Ardennes offensive had the effect of postponing it.

In this talk, I shall confine myself to the operations of 30 Corps, in the initial phases of VERITABLE, viz. the clearance of the Reichswald Forest.

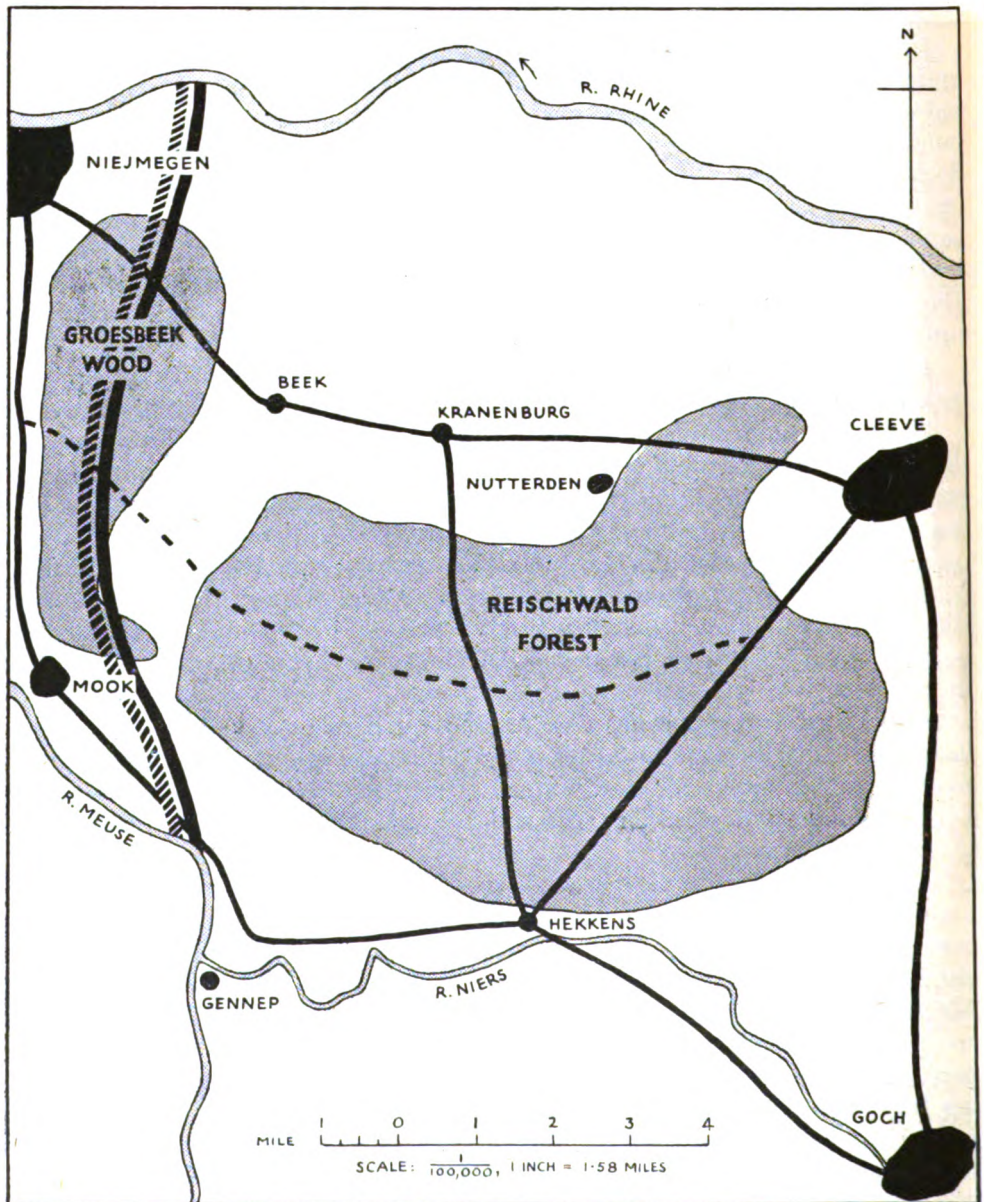
In mid-December this Corps had been withdrawn from the operations on the Roer to concentrate for the battle, and Corps planning had just started under the Canadian Army in the third week in December, when the Corps was suddenly moved south to meet Von Rundstedt's threat in the Ardennes. After that was disposed of, H.Q. 30 Corps repaired to a Dutch village called Boxel to get down to planning for VERITABLE. According to report this is the village where Lt.-Colonel Wellesley, afterwards Duke of Wellington, came across a dying soldier of his regiment called Thomas Atkins, now symbolic of the British Army.

30 British Corps was responsible for the initial stage of VERITABLE, viz. the clearance of the Reichswald Forest, and had under Command seven Divisions, viz. Guards Armoured, 15, 43, 51 and 53 British Infantry and 2 and 3 Canadian Divisions, three armoured Brigades and five A.G.R.A., plus several Regiments of specialized arms.

The terrain was the Groesbeek Wood followed by the Forest proper, an undulating feature approximately 10 by 6 miles, consisting of heavily wooded bog and moorland, rising at intervals to dominating strong-points, flanked on either side by low-lying country, swamped by the flood waters of the rivers Meuse and Rhine. There were three main lines of enemy defences, the central one being the northern end of the Siegfried Line—altogether the forest was a pretty formidable obstacle. On the southern flank there was a good road leading from Mook via Hekkens to Goch; on the northern aspect a good road led from Nijmegen via Beek and Krannenburg—Nutterden to Cleeve, the home of Henry's Anne (ungallantly referred to as the Flanders Mare). Throughout the forest itself there were various tracks.

(27) The plan of the assault was to attack on a four divisional front, 51 Division, 53 Division, 15 Division east through the forest, 2 (and subsequently 3 Canadian Division) north-east towards the Rhine, with 43 Division and Guards Armoured Division in reserve ready to break through and exploit success.

OPERATION VERITABLE—PHASE I



The battle started on February 8, preceded by the customary air bombardment and a barrage from over a thousand pieces of artillery.

(28) The Corps medical plan was three C.C.S.s in Nijmegen, one in Grave and one in reserve. The forward C.C.S. in Nijmegen was just two miles from the enemy lines—deliberately sited there to avoid subsequent movement, and it is interesting to record that the nursing sisters who were moved in two days before the battle, had no complaint against intermittent shelling by the enemy, but had a mild “beef” against the noise and din of our own artillery who opened up their bombardment at 0500 hours on February 8.

Collection and evacuation of casualties followed the usual routine for the first two days. Thereafter, owing to the atrocious weather, the tracks through the middle of the forest deteriorated to such an extent that even the ambulance jeeps got stuck, which resulted in a hand carry by stretcher-bearers of over 1,000 yards. Next, owing to flooding, the main northern road became impassable and for a distance of five miles from Beek to Nutterden the water was five feet deep, making maintenance impossible for either wheels or tracks. This had been foreseen and recourse was made to our old friends the DUKWs which had been brought up to Nijmegen from the Rear Maintenance Area away back in Normandy.

For over a week the maintenance of the three northern divisions in the attack was made by these marvellous amphibians. They filled up with ammunition and supplies at Nijmegen, set forth on the northern road, took to the water west of Krannenburg, waddled steadily through five miles of inundated territory to east of Nutterden, deposited their loads on dry land and filled up with wounded for the return journey. It was arranged that after dumping their supplies they formed a cab rank with never less than six vehicles in the rank, for conveyance of casualties. A DUKW Casualty Loading Centre was set up in this cab rank to embark the casualties; the DUKWs after their return amphibian journey, delivered the casualties at the front door of the C.C.S. at Nijmegen. The drivers got quite a kick out of it.

As many of the wounded had to be evacuated out of the forest by weasels (which are in effect amphibian Bren Carriers), and as, after treatment in the C.C.S. the lighter cases were taken back to the airfield by T.C.V. (Troop Carrying Vehicle) for air despatch to U.K. by Dakotas, many of those wounded in the Reichswald Forest arrived in England by methods of transportation which had not passed the “project” stage when the war started.

(29) The first phase of operation VERITABLE, viz. the clearance of the Reichswald Forest was completed by February 13. During this period of progress against natural and artificial obstacles 30 Corps disposed of approximately 6,000 casualties in six days.

In this phase of operation VERITABLE the average time taken by a casualty to reach a C.C.S. from the time of being hit was 4 hours and 40 minutes, and the recovery rate of cases which reached the C.C.S. was 94 per cent. I wish to say that this is a very satisfactory result.

(30) VERITABLE was completed on March 10 by which date the Allied Armies were lined up on the left bank of the Rhine. For the thirty days' continuous

engagement the casualties of the troops in 1st Canadian Army consisting of 30 British Corps (which were in the majority) and 2 Canadian Corps, amounted to approximately 15,000, of whom over 11,000 were wounded.

In addition to allied wounded, we naturally collected a goodly number of enemy wounded, who generally speaking accepted their fate with resignation, but it was interesting to find as late as February of 1945, one enthusiastic Nazi, who, rather than suffer an injection of British blood, plucked the life-saving needle from his arm and so perished, fanatically glad to die for his Fuhrer's forlorn cause.

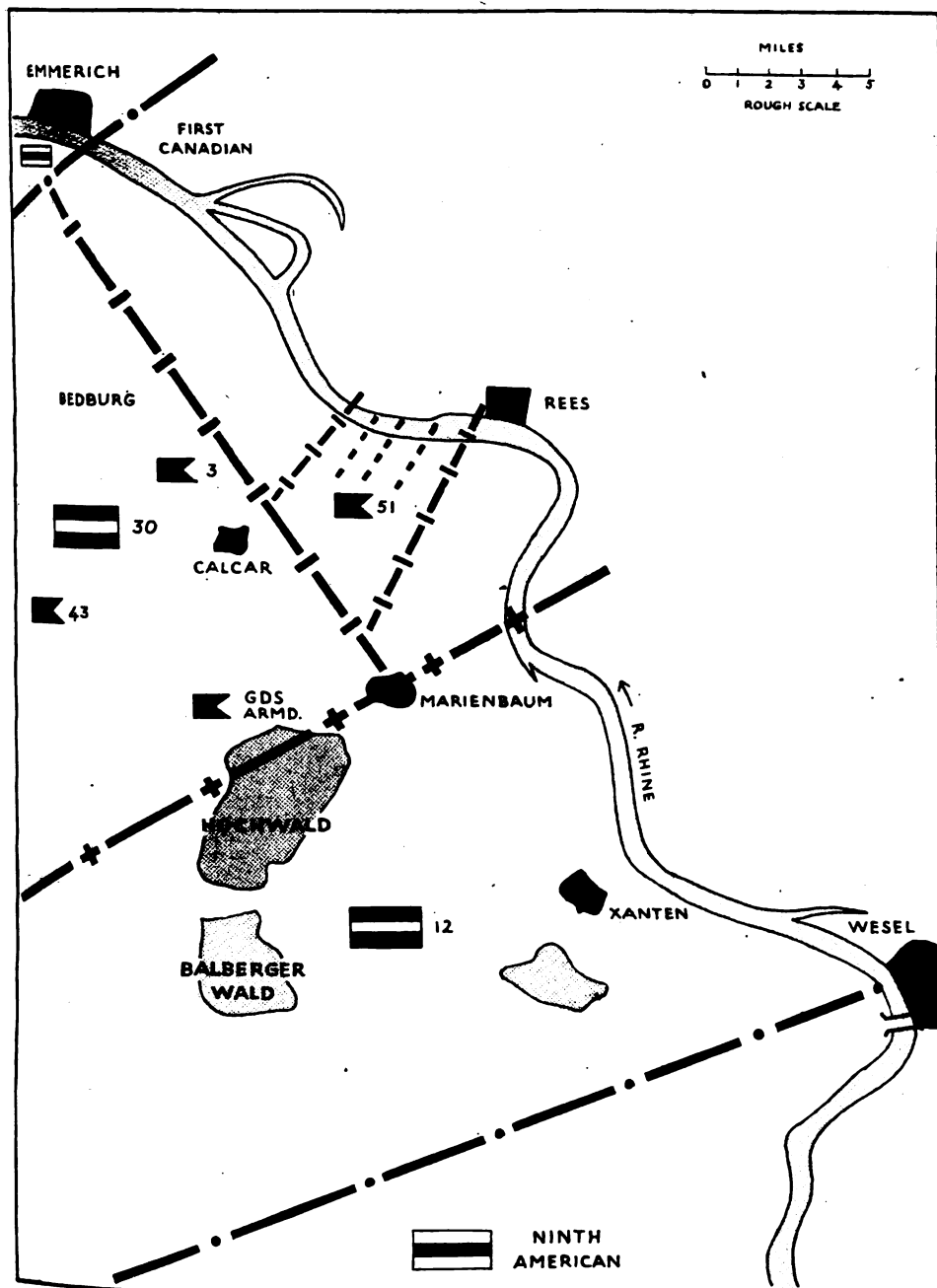
(31) We will now deal very briefly with the medical aspect of a river crossing—in this case the Rhine—operation *PLUNDER* which, as you know, took place on the night of March 23/24, 1945. So far as the British Army was concerned, the plan was to cross on a two Corps front, viz. 12 Corps and 30 Corps between Wezel and west of Rees. 12 Corps were to be assisted in this operation by 6 Airborne Division, timed to drop about 5 miles east of the river, eight hours after the initial crossing. The American IX Army on the right had similar assistance from the air, and it was a wonderful sight to see some 3,000 aeroplanes and gliders drop 14,000 troops on to the battle area between 1000 and 1300 hours on the forenoon of March 24.

For this assault crossing much preparation had been made in advance, for example 30,000 tons of Engineer Stores had been assembled for Bailey bridging. The river was 400 to 500 yards wide with a $3\frac{1}{2}$ knot current. A "Bank Control Group" was formed, corresponding to the Beach Group of the Normandy landings.

(32) In 30 Corps the plan was to pass 51 Division through a holding Division, on a four battalion front, with remaining Divisions poised to cross as soon as the river head was secured. 51 Division set out in their assault craft at 2100 hours on March 23 and quickly secured a foothold on the opposite bank.

(33) The medical plan was simple. The two Corps C.C.S.s were in Bedburg, some six miles behind the river. The medical units of the holding Division opened their A.D.S.s, and a Corps Field Ambulance provided four Casualty Collecting Posts on the near bank, corresponding to the assault crossings: relays of ambulance cars were used between these, the A.D.S.s and C.C.S.s. The result was that the assaulting Division was freed of all responsibilities on the near bank. Their medical units opened C.C.P.s on the far bank of the river corresponding to those on the near side, followed by A.D.S.s when the crossing was secured. Passage across the river was made by a ferry service of Buffaloes (L.V.T.s). This is the first time I have mentioned these, so you will excuse my dilating on their merits. This lightly armoured amphibian-tracked vehicle is the modern version of the old "Alligator" used in South American swamps. The modern version has a let-down ramp at the rear-end; it can carry a jeep or Bren carrier with comfort, and a 25-pounder gun with slight modifications: alternatively it can take about a platoon of infantry or five stretcher cases plus about 20 walking wounded. In fact for medical purposes it is in some respects better than the DUKW in that, being tracked, it can climb the banks of a river better than any wheeled vehicle—even a six-wheeled one. But it has the dis-

THE RHINE CROSSING.



advantage that its fins break up on hard roads, and so it is not quite such a dual purpose vehicle as the DUKW, and indeed on land, except for short distances, requires to be transported. Nevertheless it is a most marvellous vehicle and

for medical purposes useful more than somewhat. At the same time we felt we could not leave the faithful DUKWs out of the party, so we also established a DUKW ferry, but the banks of the river were so steep that we could not get the DUKWs to operate until we bulldozed a gradient for them. These ferry services of Buffaloes and DUKWs proved so good that we continued to use them for casualty evacuation for several days after Bailey bridges had been thrown across the river.

(34) There is no doubt that in this war there has been a tremendous advance in the transportation of casualties by land, sea and air, and that this advance has been largely responsible for the improved recovery rate of wounded, since they are brought to surgical aid before wound and shock have had time to develop. With Weasels, Jeeps, Buffaloes, DUKWs, L.S.T.s, Austers and Dakotas—all products of this war—we can transport casualties from and through anywhere and everywhere. In peacetime I feel we ought to improve the old motor ambulance, and develop air transportation to the full. In Europe as the advance developed, more and more use was made of air evacuation from Corps to Base areas, while over 50 per cent of casualties transferred to U.K. went by air.

(35) Before I close there are two small but very important points to which I wish to draw attention. First the need for adequate signposting of medical units; and second the need for accurate documentation of casualties. If we do not attend to the first, we shall have our good drivers of casualty carrying vehicles—and they are good—swanning around searching for the medical haven of refuge, while the condition of the patients is slowly and inexorably deteriorating; if we do not see to the second, we cause heartbreak and mental misery, for which there is no excuse, to the anxious relatives.

(36) WHAT OF THE FUTURE? As you know the whole concept of war is changing with the developments of rockets and atomic energy, and other potential horrors. We must watch these developments; keep an open and alert mind. and think ahead.

Clinical and Other Notes.

THE HISTORY OF A CASE OF DIVERTICULOSIS, WITH OBSERVATIONS ON TREATMENT.

BY

BERNARD MYERS, M.D., F.R.C.P.

(Consulting Physician to the Royal Waterloo Hospital.)

THERE would appear to be some diversity of opinion in various textbooks and articles, on the subject of diverticulosis, its causation, symptoms and treatment—and I believe it will elucidate the subject if the careful observations of a physician, who has suffered from diverticulosis for many years, are described.

When 44 years of age he became aware of a slight tendency to constipation, never previously experienced, together with dryness of the fæces apparently due to decreased mucous secretion. On one occasion when making a little more effort than usual at stool he felt as if something had given way internally with a crackling sensation, but there was no pain. A few days afterwards the same thing happened again. A bismuth meal was done and demonstrated the presence of a number of diverticula in the colon, especially the descending and sigmoid colon. It so happened that he had a bismuth meal six months previously when no diverticula or other abnormality were noted.

Henceforth he took care to make as little effort as possible in defæcation and a tablespoonful of liquid paraffin was taken three times daily. This proved efficacious and in a short time he was able to reduce the dose to a tablespoonful night and morning. The diet now consisted of only digestible food and all roughage excluded. No further trouble was experienced for a number of years and he led a busy professional life without any difficulty. Some time later, however, he occasionally felt an ache in the region of the splenic flexure of the colon accompanied by a little pain, probably due to an attack of diverticulitis. To overcome these symptoms a slightly larger dose of liquid paraffin was taken thrice daily, but even so it was not successful and syrup of figs once or twice weekly added to the treatment and all went well again. A year later difficulty occurred once more and irrigation of the sigmoid and descending colon was tried with very satisfactory result; a good deal of what is called "sandy material" came away with immediate and appreciable relief.

It is desirable to add a word of caution about treatment by irrigation as if the nurse be not well versed in the method or is rough or negligent great injury could be caused to the bowel. Irrigation should be performed only by those who know the subject and method thoroughly and are expert. Wisely used in this manner in suitable cases it is invaluable and I have known it to be life-saving in a desperate case of obstruction, due to diverticulitis.

The regimen now adopted consisted of most careful dieting with avoidance of all suspicious or unsuitable articles of food, liquid paraffin daily, syrup of figs once weekly and irrigation monthly. All went well for many months, when, probably from an indiscretion in diet, a severe spasm occurred in the

region of the splenic flexure with accompanying constipation. Syrup of figs failed to give relief but fortunately milk of magnesia with liquid paraffin, given together daily, was successful in removing the spasm and the bowels acted with soft stools, the pain and discomfort disappeared and complete relief resulted.

Three years ago dried bananas were tried and with such satisfactory effect that it would appear that the banana, if available in sufficient quantity and used appropriately, was likely to become an invaluable part of the diet of those suffering from diverticulosis. But every banana is not suitable. The dried variety is immersed in boiling water for ten minutes and the liquid thrown away. Thus prepared the banana proved to be not only palatal and nutritious, it produced a soft easy action. Ripe bananas give also excellent results but they should be beaten up with a fork and thoroughly masticated. Unfortunately, this fruit, although agreeing with most people, does not suit everybody. Bananas too ripe or those not sufficiently ripe may cause unpleasant symptoms.

By carefully carrying out the treatment related above the physician whose case is here described has remained in good health for twenty-five years and been able to carry on his medical work with little trouble so far as the diverticulosis was concerned but he is fully aware that deviation from the above routine would soon cause difficulties and make it impossible for him to follow his professional duties. When from time to time a spasm occurred in the colon he found great relief from a mixture of tincture of belladonna 10m, tincture of stramonium 5m, codeine phosphate $\frac{1}{2}$ gr. and chloroform water to half or one ounce; to be taken thrice daily for two days. As a matter of fact, as a general rule, two doses at four-hourly intervals remove the spasm and an action passes, the pain and discomfort disappearing.

Pain over the posterior part of the bladder sometimes occurred during defæcation until a year ago. It was most unpleasant while it lasted. Probably now the affected area has been walled off by fibrous tissue.

A moderately severe injury to the abdomen or chest may cause a marked spasm in the colon in diverticulosis as happened in this case following a heavy blow on the right side of the chest. The spasm in the splenic flexure lasted for four days with complete constipation and meteorism becoming more and more pronounced. The discomfort was great, and the ache over the splenic region never ceased. Even syrup of figs with magnesia and paraffin given together completely failed to relieve but fortunately careful irrigation successfully removed the symptoms with final relief.

Biochemical examination of the fæces a year after the first symptoms of diverticulosis showed the presence of occult blood; recent investigation after over twenty-five years obtained the same result and not unlikely it is due to the diverticulosis. All other tests demonstrated the fæces to be normal.

When an ache or pain occurs in the colon of the patient described, it is always in one of three regions—the splenic flexure (usually), or a couple of inches lower down in the descending colon, or again in the sigmoid not far from the bladder. In whatever position the pain was felt on the left side of

the abdomen, reflex pain became evident on the right side in a definite place according to the position of the left-sided pain; thus with splenic flexure reflex pain was experienced in the epigastrium, if below the splenic flexure reflex pain was felt under the liver not far from the gall-bladder, or if the pain was in the sigmoid the reflex pain was experienced in the lower part of the right loin or right iliac fossa.

CONSIDERATIONS OF IMPORTANCE.

Mayo expressed the opinion that taking the general population above 40 years of age probably over 5 per cent suffer from diverticulosis. The ages of patients vary from 28 to 88 years. The average age, when symptoms are first complained of, is about 50 years, but most likely the condition commences between the ages of 40 and 45. It is more frequent in men than in women.

As to the position of the diverticula they are most frequently found in the sigmoid colon but are sometimes encountered in the region of the cæcum and may occur between these regions. In a number of cases they exist only in the sigmoid. Occasionally the condition is found in the upper part of the rectum, or may occur higher up than the cæcum. Generally speaking it may be taken that diverticula are multiple and vary in size; that is, they may be the size of a pea or larger; sometimes they are triangular in shape and tend to become sac-like, the mouth of the sac opening into the bowel. If the sac walls are inflamed changes occur in the shape and the same thing may happen if the muscular coat disappears. In some instances the sac mouth becomes narrowed. In a certain number larger sacs are met with in the transverse or ascending colon.

It has been stated that diverticulosis can be looked upon as herniation of the intestinal mucous membrane through gaps in the musculature; the muscular tissue remaining in the sac shows a tendency to become atrophic. Obviously a barium enema and X-rays is the method by which diverticulosis can be well demonstrated.

Secondary changes may be produced by retention of irritating fæcal matter and diverticulitis makes its appearance. In "Diverticula and Diverticulitis of the Intestine" by Harold Edwards, he states that diverticulosis may pass on to acute diverticulitis and perforation with general peritonitis, or to local abscess and the latter may track to the surface in the left iliac fossa or rupture into the bladder or other hollow organ. Chronic diverticulitis may, on the other hand, appear from diverticulosis and produce pericolicitis with symptoms of obstruction or adhesion to neighbouring organs.

The symptoms presenting themselves in diverticulitis are pain, constipation, with perhaps some mucus and blood in the stool. In a number of cases bladder symptoms may appear. Diverticulitis, if uncomplicated, is treated medically, and, most important, constipation must be effectively treated to avoid great discomfort. The importance of preventing any indigestible article in the diet, or likely to prove unsuitable, is essential. The diet must be soft, bland, easily digestible, and quite free from any fibrous shreds or indigestible matter; thus nuts, hard fruits, fibrous roots and any roughage of any kind whatsoever must be avoided. Some potatoes are suitable, others not. Among unsuitable

articles of food must be mentioned stringy vegetables, hard fibrous meat, celery, etc. Soft pears, mashed just-ripe bananas, and quite an appreciable amount of fruit juice are allowable. Of course, mashed potatoes, young sprouts, well cooked and well cut up and minced spinach are suitable. If there be any doubt about the seeds of tomatoes they should be avoided. Fish, poultry without skin, tender meat, lightly toasted bread without crust, digestible biscuits, butter and jam without seeds or fruit skin are very suitable and if properly masticated give rise to no trouble.

Some authorities are of opinion that meat should not be taken in diverticulosis, but my experience is that if fresh, tender meat be selected and just correctly cooked and then well masticated it is most unlikely to give any trouble. Tea, freshly made, is suitable and if it be desired whisky and water or beer can be taken if the gas from the latter causes no digestive trouble.

It is a wise procedure to add vitamins to the diet as, for instance, Completive or Bemax as I believe they add to the patient's well-being.

Should complications appear, as chronic obstruction, abscess, or bladder symptoms, etc., the surgeon should be called in without delay.

It is important to note that careful investigation of the facts suggests that there is no causal relationship between diverticulosis and carcinoma.

CONCLUSION.

In the first place, there is no need whatsoever for any individual who may suffer from diverticulosis to be pessimistic about his condition as with careful and correct treatment experience has shown it can nearly always be controlled and the individual lead a useful and happy life.

Food is most important, and only that which is suitable, sufficiently nourishing, digestible, non-irritating to the diverticula, and not constipating, should be partaken, and unsuitable food and roughage of all kinds scrupulously avoided. Thus, fish, poultry, red meat, potatoes, green vegetables, spinach (well prepared), cauliflower, peas, marrow, well-cooked small carrots, sprouts, junket, milk puddings, bread and butter, marmalade and jam free from seeds or peel, milk, tea and occasionally coffee, can form part of the daily diet. Custard and stewed fruits without seeds are admissible, as are baked apples. There is no harm in salads providing they are well cut up, digestible, and the salad dressing made with oil. Whisky and soda or whisky and water may be partaken of occasionally. It is always of great importance that the knife and fork be made good use of and food of every kind be thoroughly masticated.

It is desirable that two motions be passed daily and for that purpose liquid paraffin, taken twice or thrice daily in doses of a tablespoonful, a little more or a little less, is of first-class importance. If the first daily dose of paraffin be taken twenty minutes before breakfast it will act more effectively. To help matters, porridge, stewed prunes, rhubarb, dates, mashed ripe, but not over-ripe, bananas, stewed plums and greens and salads are invaluable.

Should a spasm occur with its attendant pain and constipation, the mixture already quoted, containing belladonna, stramonium and codeine phosphate relieves the spasm generally after the second dose, but if necessary a third dose

would be taken. The application of warmth to the abdomen, in the shape of a hot-water bottle is valuable, and a hot bath is useful. In a number of cases liquid paraffin followed by syrup of figs and milk of magnesia taken together relieve the constipation. Still in some cases irrigation is required, and that should never fail in all ordinary cases, unless conditions are such that surgical intervention is called for.

After an accident or operation to the abdomen or chest, a spasm of the colon may follow and the belladonna mixture with irrigation may be required to give relief.

Finally an occasional holiday under pleasant conditions where treatment can be continued is to be recommended.

APPENDIX.

A patient informs me that in irrigation of the colon her procedure is as follows: She uses 12 to 16 gallons of weak sodæ bicarb. solution (a teaspoonful to the quart) and makes the temperature 100 to 102°F. After the first 8 gallons a very pale solution of permanganate is used. Great patience is essential and only a pressure of about 12 inches allowed. This is regulated by the height of the glass container above the bed. The tube is not inserted high up at first, but the lower bowel is washed out, or if necessary a small soap and water enema given beforehand, and then the tube gently put farther up by degrees, but *no* force is used. In some cases the result is quickly obtained but the greatest patience is necessary as it takes an appreciable time to wash out the bowel thoroughly.

The patient lies on his left side to begin with, and then turns on his back; sometimes moving over to the right side for a few seconds and back to the left side again. In acute cases 6 ounces of olive oil is used, being retained an hour before treatment, and is very beneficial.

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Part II.

BY

Lieutenant-Colonel R. GWYN EVANS, *M.B.E.*, *M.B.*, *M.R.C.P.*

Royal Army Medical Corps (T.A.)

Late A.D.M.S., Second Army—B.L.A.

(Continued from page 72).

CHAPTER III.

THE LIBERATION OF SOUTHERN HOLLAND AND THE WINTER CAMPAIGN OF 1944/45.

THE advance from Belgium into Holland was carried out by Second Army with one Corps up (30 Corps). 12 Corps protected the left flank and 8 Corps was in process of moving up from the Seine area.

This next phase was likely to be difficult if the enemy resisted in strength owing to the large number of water obstacles.

A move was made on September 6 by Guards Armcd Div who secured a crossing over the Albert Canal and were then directed on Eindhoven. The bridge over the Albert Canal at Beeringen had been destroyed but although a bridgehead was secured an enemy revival now occurred and resistance stiffened considerably, particularly in the Hechtel area and fierce fighting ensued on September 8 and 9.

The advance was to be continued on September 10 by the capture of the de Groot Bridge over the Escaut Canal. After a day of probing and most interesting fighting the bridge was captured at last light and the position was to be strengthened on September 11 and in fact the Guards Armcd Div pushed well on to Valkenswaard.

Meanwhile 11 Armcd Div relieved of its commitments at Antwerp came up on the right of the Guards Armcd Div. At the same time 12 Corps who had been fighting their way through Belgium were relieved in the Ghent area on September 11 and moved up on the left of 30 Corps. The period September 12 to 17 saw the final clearing of Belgium and the stage was set for the entry into Holland.

In preparation for the advance into Southern Holland 8 and 39 General Hospitals (600 beds each) had been placed under command Second Army, and were moved forward to Brussels where 8 General Hospital relieved 86 General Hospital on September 12, 1944. 81 and 86 General Hospitals were now available and were moved up to establish a forward hospital area at Diest (K167). 24 Casualty Clearing Station remained open at Malines, whilst on the right flank 34 Casualty Clearing Station had moved forward to open in the Helchteren area at Sonnis (K367768). This left 30 Corps with both 3 and 10 Casualty Clearing Stations closed and available to move forward as operations developed, whilst on the flanks both 8 and 12 Corps each had one Casualty Clearing Station (23 and 33 Casualty Clearing Stations) uncommitted and available to move forward when required. Finally 24 US Evacuation Hospital (which had been placed under command Second Army for 82 and 101 US Airborne Divisions) was established in the Bourg Leopold area.

Advanced Depots Medical Stores were opened in Brussels and at Diest (for the forward areas); 8 Advance Depot Medical Stores was held in reserve for 30 Corps; "Y" Blood Bank was established at Diest.

Evacuation of casualties by ambulance car coy was strictly controlled, so that only casualties from 30 Corps were evacuated to Diest; casualties from 8 and 12 Corps were cleared by road direct to Brussels or Antwerp. General Hospitals at Diest were evacuated by ambulance car or sparrow aircraft to Brussels, whence provision had been made for casualty air evacuation direct to UK, and also for evacuation by temporary ambulance train (staffed by the Belgian Red Cross) to Amiens.

For some time plans had been in being for an airborne landing in Holland to co-ordinate with the advance of 30 Corps but by September 11 it was decided that the time was not yet ripe. However with the imminent clearance of Belgium it was decided that the big gamble of an attempt to sever Holland from Germany and turn the whole of the Siegfried defences from the north was justifiable but would need a big-scale operation to succeed.

- Operation MARKET GARDEN was laid on and a regrouping of Second Army took place to include four Corps 8, 12, 30 and the British Airborne Corps. Two American and one British Airborne Divs and one Polish Parachute Brigade were included in the force.

The plan, an ambitious one, consisted in an attempt to dominate the only road on which an advance of 30 Corps could take place and to seize the bridges over the Maas and the Waal in the areas Grave and Nijmegen and also those over the lower Rhine at Arnhem.

Meanwhile 8 Corps was to work up to the Maas protecting the right flank, 12 Corps also to move progressively up to the Maas on the left capturing Rithy and Turnhout on the way.

The attack was planned to take place on September 17 and everything went well with both ground and air forces except in the far north at Arnhem. The bridges at Veghel and Grave were captured intact, but that at Zon was destroyed; it however presented no difficult bridging problem. After a set attack

by elements of 82 US Airborne Div and Guards Armd Div the Nijmegen Bridge was captured intact.

Difficulties in dropping reinforcements at Arnhem added to the complications and after a protracted and very gallant stand by the 1st Airborne Div

ANNEXURE "A" TO CHAPTER III.



and equally gallant attempts by Guards Armd Div and 43 Div to reach them, the forces at Arnhem were compelled to withdraw.

The axis for medical evacuation from 30 Corps (along the road Uden-Veghel-St Oudenrode-Eindhoven) was cut by the enemy on two occasions between September 20 and 24, 1944 with consequent adverse effects on casualty evacua-

tion by ambulance car. Unfortunately 3 Casualty Clearing Station were unable to open in Nijmegen until September 22, 1944, and as the forward move of 10 Casualty Clearing Station was delayed by the cutting of the Corps axis, a large number of casualties had to be held in the Nijmegen area. Air evacuation

ANNEXURE "B" TO CHAPTER III.



from Grave appeared uncertain, and it was therefore decided to move 35 Casualty Clearing Station from Antwerp (where they had been relieved by 9 General Hospital) to Eindhoven to establish a Casualty Air Cushion for air evacuation from the Eindhoven airfield. Evacuation of casualties from 8 and 12 Corps presented no difficulty, with Casualty Clearing Stations open at Zeelst (E3816) and Geldrop (E4816).

Repeated attempts to establish contact with medical units of 1 Airborne Div met with no success; it was obvious that these medical units would be extremely short of supplies, and on September 24, 1944 Commander 163 Field Ambulance with a volunteer detachment from his unit made a gallant attempt to get through to 1 Airborne Division with the necessary supplies under cover of the Red Cross. This party was captured, but after a delay of some hours, the enemy decided to retain the Commander, and accorded the remainder of the party safe conduct to the British lines.

The officer commanding 163 Field Ambulance who remained in captivity for approximately one month assisting in the organization by all the means in his power. Later he also succeeded in escaping.

Mention must be made also of the excellent work of the ADMS 1 Airborne Div who remained behind and organized the care and treatment of the wounded. By his forceful personality and splendid example he forced the enemy to accede to his demands and no praise can also be too high for the RAMC personnel who worked under him. Out of approximately 500 all ranks RAMC of 1 Airborne Division only 1 officer and 13 other ranks came back from Arnhem. It is gratifying to record that only when all that could be done had been carried out and when the British casualties were finally being evacuated to Germany this officer managed to make his escape and reach our lines in safety.

The withdrawal of 1st Airborne Div (covered by the 43 Div) succeeded in evacuating approximately 2,800 troops, but all wounded amounting to approximately 1,200 had to be left behind with the Divisional medical units.

Whilst MARKET GARDEN was in progress 8 and 12 Corps carried out operations to secure both flanks which at the time of the Arnhem battle were very vulnerable.

8 Corps was to establish a bridgehead over the Meuse-Escaut Canal and capture Hamont-Achel while 11 Armd Div was to continue the advance and secure the area Helmond-Bakel-Deurne-Somereren. 3 (Br) Div captured Weert and linked up with 11 Armd Div in the area Asten.

50 Div, now under command 8 Corps, captured Volkel and advanced to the Maas in the area of Cinik. With further advances of 11 Armd Div NE of Helmond the enemy resistance in this area was rapidly reduced but to the immediate east and south-east owing to the divergence of Second British Army and First US Army necessitated by Operation MARKET GARDEN there remained a definite threat. Enemy resistance in the area Someren-Overloon to the outskirts of Maastricht remained a nuisance value for a considerable time.

As Second Army resources in this area were at this time slender, 7 US Armd Div was moved up on September 29 to the Deurne-Asten area. 12 Corps at the same time (with 15 (S) Div as usual well to the fore) had heavy fighting in the area of Best and also in its subsequent progress towards S'Hertogenbosch.

Regrouping of Army medical units now took place, and a forward hospital area was established in Eindhoven with 79 General Hospital (600 beds), 81 and 84 General Hospitals (200 beds each) at Sterksel, and 35 Casualty Clearing

Station as casualty air evacuation cushion at Meerveldhoven (E385157). 86 General Hospital was later moved from Diest to Eindhoven.

8 Corps had established two medical areas to cover the 70 mile front, opening a northern medical area at Handel (E5943) and retaining that at Geldrop to cover evacuation from the southern part of the Corps front. Disposition of 30 Corps medical units remained unaltered, whilst 12 Corps opened a second medical area at Grave (in addition to the Casualty Clearing Station area already established at Zelst).

At this stage Second Army was confronted with its first major civil affairs problem, the removal of the population from the Nijmegen island and from Nijmegen itself. This was put into effect mainly through a transit area, at Eindhoven, and here medical resources were called upon to deal with the dusting of these large numbers. Similar problems soon arose on the 8 Corps front in the evacuation of the river zone of the Maas.

A daily ambulance train service was instituted on October 1, 1944; initially ambulance railhead had been established at Overpelt, but on October 10, 1944 it was moved forward to Valkenswaard where it remained during the winter months.

Now followed a period of comparative inactivity in which no great movement took place but throughout the winter operations Second Army continued to nibble at the enemy's defences and ensure the maximum wastage of his man-power and equipment.

It is unnecessary to record all the various operations which ensued as 8 Corps medical units remained in situ for a considerable period as they were well placed for any activity that occurred on their long front. 12 Corps and 30 Corps units moved only in conformity with their own formation moves to new areas whilst the Army units remained in their two areas throughout the winter and in fact until shortly before the Rhine assault.

These various operations were all a continuation of the plan to clear both flanks which had been part of the task in Operation MARKET GARDEN.

On the right in view of the severe winter conditions which ensued later it is worth noting the appalling state of the country in this area—one mass of waterways and waterlogged ground.

In the north regrouping took place and 12 Corps took over the responsibility for the Nijmegen "Island" on night October 7/8 to enable 30 Corps to confine its attention to that area north of the Meuse in which the approaches to the Reichswald Forest were. An attack (to be carried out in conjunction with 8 Corps) to storm this fortress was planned but never carried out until a later date when Operation VERITABLE was put into execution by First Canadian Army.

Operation CONSTELLATION is worth noting from the medical point of view from two aspects:—

- (a) It was the operation in which minefields and in particular anti-personnel mines made their biggest appearance to date. This was regrettably shown in the very large number of amputations required, in one month almost equal to the previous total.

- (b) The presence in Venraij of two very large lunatic asylums, one male and one female. These had to be evacuated whilst the battle raged around partly for the sake of the inmates and partly because they were very definitely a tactical encumbrance. The conditions in which they had been compelled to live as the battle approached might have become appalling had it not been for the unselfish care of the Nuns and Monks. The difficulties of removing a large number of bed-ridden and amongst them many violent cases in the hurly burly and noise of battle can easily be realized.

Operation PHEASANT was next on the list commencing on October 22 and was carried out by 12 Corps, in co-ordination with 1 Corps (First Cdn Army) to capture area S'Hertogenbosch-Tilburg-Brede.

Neither of these calls for special mention.

Whilst these operations were in progress the enemy launched a determined attack on October 27 against the sector of the extended 8 Corps front which was held by 7 US Armd Div. The enemy made considerable penetration at several points and during the night obviously achieved a considerable build-up as a counter attack put in at 0700 hours on October 28 telescoped with one by the enemy. He succeeded in capturing Meijel and at one stage reached the Meijel-Asten road 2 miles north-west of Meijel so that at this stage there was very little between him and the 8 Corps medical area Heeze-Geldrop and 84 Gen Hosp at Sterksel. However the situation was relieved by a quick switch of 15 (S) Div from 12 Corps immediately after their capture of Tilburg. By the 30th no further enemy penetrations were made and 8 Corps resumed the offensive recapturing Liesel on October 31.

7 US Armd Div however only made slow progress and by November 5 Meijel was still not retaken.

Evacuation from 7 US Armd Div whilst it was under command of Second Army represented no difficulty; evacuation was through the Division Medical Battalion to a Field Hospital platoon near Heeze (adjoining the 8 Corps medical installations at Geldrop).

During the period that 7 US Armd Div were under command 8 Corps the appalling conditions in that area made "trench foot" a very real danger as a fair number of cases began to make their appearance. The US Medical Services very soon took control of the situation but throughout the winter it was obvious that they were very definitely more prone to this condition than the British troops as their wastage from this disability remained high throughout.

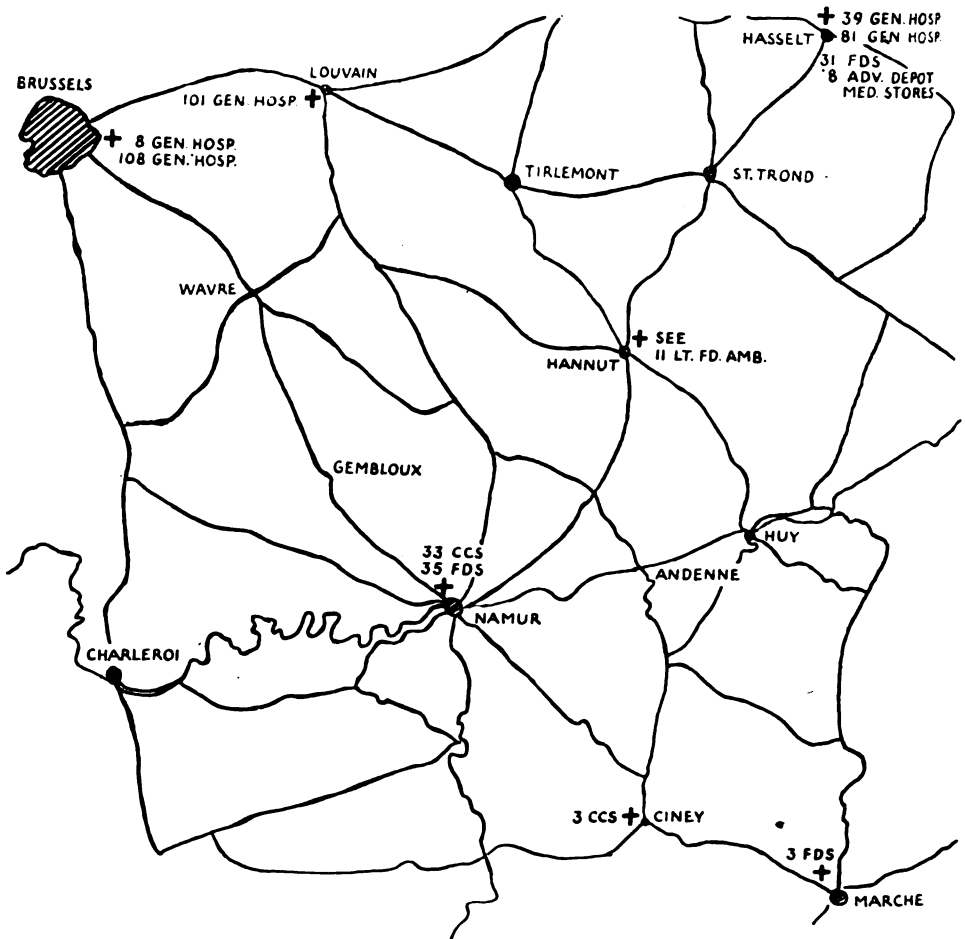
Trench foot never at any time caused any concern amongst the British troops. Instructions as to methods of prevention were issued early and all precautions taken so that the numbers remained incredibly low.

Other diseases in 7 US Armd Div seemed to run very much in parallel with our figures except in the case of gastro-enteritis in which theirs were very much lower. It would seem that this might be due to better cookhouse discipline and a higher standard of cleanliness and washing arrangements of all cooking and feeding utensils. That it must be something of this nature is presumably evident from the constancy in the ratio of the figures.

Diphtheria which was endemic in that part of Holland proved a very definite problem throughout the winter and a large number of cases were recorded. The majority of these were very slight but it was ruled that all should receive the same length of treatment. At one period only one death in 500 cases was recorded. Arrangements were also made to give laboratory facilities to the civilian doctors in and around Eindhoven.

During the regrouping of Second Army in preparation for the liquidation

ANNEXURE "C" TO CHAPTER III.



of the final enemy pocket west of the Meuse, it was decided that the Eindhoven hospital area could safely be reduced in size and a subsidiary hospital area be established to the south. 81 General Hospital closed, and moved south to Hasselt, where it was joined by 39 General Hospital (600 beds) forming a hospital area to cover the southern part of the Army front. Ambulance trains from Valkenswaard (*en route* to L of C) were halted at Hasselt to entrain casualties requiring evacuation.

To the north, 8 Corps retained its existing medical area at Handel and Heeze and continued evacuating to Eindhoven. 12 Corps opened 24 Casualty Clearing Station at Hammont (4797) and later established a forward Casualty Clearing Station at Weert (E5807); evacuation was to Eindhoven. In the south, the 30 Corps medical units were located at Eysden (5668). General Hospitals in the Army area implemented a ten to fourteen day holding policy which was augmented by two to three weeks' convalescent treatment at 13 Convalescent Depot Bourg Leopold; this policy paid a handsome dividend in economy of man-power. Evacuation from Army area was to L of C General Hospitals at Louvain, Brussels, Rennaix, Lille and Amiens.

Surgery.—During the static period it was soon obvious that the change from tents to buildings had been of no advantage to the surgical case as chest conditions which had previously been conspicuous by their absence now began to make their appearance. On the other hand with the greater facilities for post-operative treatment improved results became apparent. This once again emphasized the value of post-operative care and the need of an increase in the nursing officer potential of a Casualty Clearing Station particularly in rush periods.

This period of lighter work enabled forward surgeons to visit Base and L of C areas to get an idea of the after-results of their forward surgery. This was of value and no doubt resulted in certain modifications of their technique based on the results they saw and also the effect of long journeys in particular types of cases.

Medical officers now had time to indulge in research and special attention was paid to the conditions fat embolism and the crush syndrome. In one series of 69 amputations there were seven deaths, two due to crush syndromes, three to fat embolism and two to shock.

Reference has been made to the increased incidence of amputation due to mine injuries. An observation was made at one Casualty Clearing Station that wearers of rubber gum boots seemed to suffer less severe injuries than those without but from inquiry over a long period this does not seem to have been proved.

VD.—During the periods VDTCs were attached to Corps and immediately justified their existence. It soon became apparent that the correct policy was to site these units centrally in each Corps area and as far forward as possible in the Corps rear area where they were most easily accessible to all. Treatment of all cases of VD whether gonorrhœa or syphilis were then carried out at the VDTC by the venereologist (and not by any other MO or at any divisional medical unit). Only in this way could the maximum saving of man-power be effected and continuity of treatment and observation be assured. Conversely the PAC except in the large towns did not justify its existence, certainly at Corps level.

THE ARDENNES.

Whilst the regrouping of 30 Corps was taking place, in preparation for operation VERITABLE, it was decided to retain the two General Hospitals (39 and 81) in the Hasselt area, but to retain only three of the existing Corps medical

areas, namely at Helmond (34 Casualty Clearing Station), Weert (23 Casualty Clearing Station) and Eysden (10 Casualty Clearing Station).

All the plans for regrouping both the US Armies and 21 Army Group were put out of action by the attack launched by the enemy with the Sixth SS Panzer Army on December 17 against the First US Army. By December 19 the enemy had advanced 25 miles on a 20-mile front and showed signs of preparing to swing north-west towards the River Meuse at Liege, his final objective being the cutting of our L of C and the capture of the port of Antwerp.

As a result of this a striking force was formed by 30 Corps to intervene in the Ardennes battle.

This force consisted of Guards Armd Div, 43 Div, 51 (H) Div, 53 (W) Div and two tank bdes; in addition 29 Armd Bde, under command 21 Army Group, and 2 HCR, under commander Second Army, entered the fray.

21 Army Group assumed command of the Ninth and First US Armies and so took over the northern sector, and to help the Ninth US Army 51 (H) Div and 6 Gds Tk Bde were moved to an area east of Maastricht.

On December 23 2 HCR and 29 Armd Bde made contact with the enemy east of Dinant, but by Christmas Day the attack had lost its drive and the other formations in the 30 Corps striking force had little to do but a general hastening of the enemy's retirement.

Medical installations were well placed to support 30 Corps in their counter attack, and in addition three Casualty Clearing Stations were uncommitted and available to move at short notice.

On December 21, 1944 instructions were issued for evacuation of casualties from divisional medical units within 30 Corps to be arranged direct to General Hospitals at Hasselt, and in the case of 51 and 53 Divisions to L of C General Hospitals in the Louvain-Brussels area. Evacuation was by MAC ambulance cars.

3 Casualty Clearing Station was moved to Charleroi (K6606), where it opened on December 27, 1944. As the Corps attack developed, 33 Casualty Clearing Station was moved south to St Servius (J9413) in the Namur area where it opened on December 31, 1944. Forward surgical cover (which was very necessary owing to the uncertain evacuation over icy roads, often further hampered by fog) was provided by opening an advanced surgical centre at Ciney (P1291).

By January 6, 1945, it was possible to move 3 Casualty Clearing Station forward to Ciney, and a further advanced surgical centre was established at Marche (P2984) to cover the final phase of the Corps advance. The evacuation route was through Ciney to Namur (where 33 Casualty Clearing Station acted as a casualty staging centre) thence to General Hospitals at Hasselt; a detachment of 11 Light Field Ambulance opened a casualty staging post at Hanunt (K1233) mid-way between Namur and Hasselt to cover the long evacuation route.

In spite of the wintry conditions and very severe frost, the general health of the troops remained excellent. Only 14 cases of trench foot were reported from 30 Corps during this operation (16 cases per thousand of British Troops

engaged). On the other hand, examination at the Army cage of 306 POW (captured during the operation) revealed 36 cases of trench foot—an incidence of 117·6 per thousand!

The low incidence of trench foot in British formation was due to the following factors:—

- (i) Good leadership by officers and NCOs ensuring good foot hygiene and adequate reserves of socks with facilities for washing and drying socks on a company basis.
- (ii) Wearing good fitting, well-greased ammunition boots and NOT rubber boots.
- (iii) High standards of foot hygiene amongst the men.
- (iv) Good general supervision of health including imitation of tours of duty in forward positions, hot food and drink even in exposed positions, and adequate rest periods.

CHAPTER IV.

THE CLEARANCE OF THE MAAS—RHINE AREA.

Operation BLACKCOCK which can be taken as the first operation connected with the clearance of the Maas-Rhine area did not necessitate any alteration in the disposition of Army General Hospitals, since 39 and 81 General Hospitals at Hasselt were well placed to receive casualties from Casualty Clearing Stations in the 12 Corps sector east of the Meuse.

When the attack opened on January 16, 1945, 10 Casualty Clearing Station at Eysden (K561682) received casualties from 7 Armd Div, whilst casualties from the centre and right of the Corps front were evacuated to 24 Casualty Clearing Station at Biest (K662594). During the commando operations, the first VC to be gained by the RAMC during this war was posthumously awarded to L/Cpl Eric Harden, RAMC of 45 RM Commando.

Apart from the move of 23 Casualty Clearing Station to Eysden to relieve 10 Casualty Clearing Station (required for 30 Corps) there were no further moves of Army medical units during operation BLACKCOCK; the number of battle casualties in the latter phases of the operation was surprisingly low, and consequently the planned opening of a Casualty Clearing Station in the Sittard area was rendered unnecessary. In spite of the bad weather conditions which prevailed during this operation the sickness rate amongst those British troops engaged remained surprisingly low.

During the progress of the Ardennes battle the First Canadian Army had proceeded with the plans for Operation VERITABLE, which had had to be postponed by the removal of 30 Corps, and with their return everything was now favourable for its inception.

After discussing with DDMS First Canadian Army his medical plan for operation VERITABLE, a number of Second Army medical units were made available to be placed under Cdn Army command for 30 Corps, including three Casualty Clearing Stations, eight Field Surgical Units and five Field Transfusion

Units and in addition to the normal Corps allotment, a second Motor Ambulance Convoy (less one platoon). Furthermore, Second Army provided facilities for air evacuation of Canadian Army casualties from Eindhoven and retained the responsibility for all medical supplies required by 30 Corps and formations under its command. As operation BLACKCOCK had progressed the Second Army General Hospital areas at Eindhoven and Hasselt were reduced in size, and a forward hospital area was established at Venraij (9 and 81 General Hospitals).

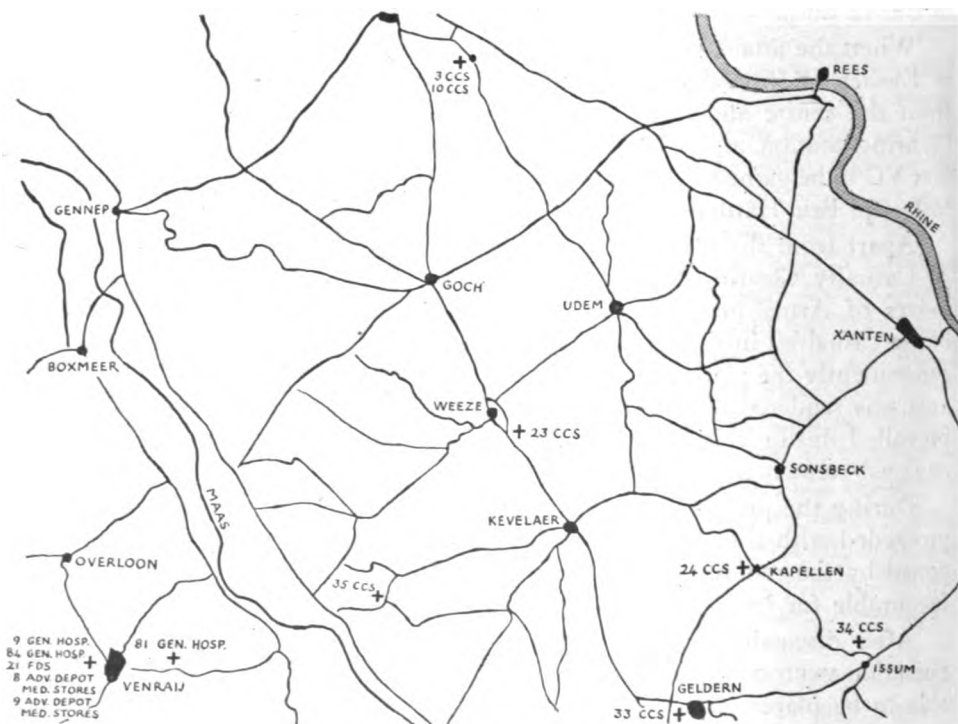
The Canadian Army attack commenced on February 8, and had as its objective the clearance of the whole area between the Maas and the Rhine from the north of the Reichswald Forest to the line Venlo-Gewene-Wesel. It proved a hard nut to crack, and it was not until March 11 that the whole area was finally completely cleared.

During the final phase of the operation, casualties from 30 Corps were evacuated over Well and Mock Bridges to 81 General Hospital (which had opened on March 9, 1945, while under command Second Army) at Oostrum (E8216) in the Venraij area. In this way every possible assistance was afforded from the medical resources of Second Army to assist the Canadian medical plan.

ASSAULT OF THE RIVER RHINE, AND THE PURSUIT TO THE BALTIC.

The stage was now set for the final act, and the first scene, the Rhine assault, would obviously be the *pièce de résistance*. The US, British and Canadian

ANNEXURE "A" TO CHAPTER IV.



Armies were lined up to the River Rhine and the enemy knew what to expect.

The medical planning for the Rhine assault, in common with that of other Services of Second Army, commenced early in February. For the medical plan the first priority was the selection of suitable accommodation for a hospital area, taking into consideration the probable location of airfields and possible ambulance railhead sites. It was soon apparent that Venraij filled these requirements, and it was decided to use one large lunatic asylum, a theological college and the gymnasium school; a large amount of repair work was required to make this accommodation habitable for hospitals, but every possible assistance was given by the Royal Engineers who achieved wonders working under the greatest difficulties. This accommodation was allotted to 9, 81 and 84 General Hospitals and 21 Field Dressing Station, giving a holding capacity of 1,200 beds capable of crisis expansion if necessary to 2,000 beds. "Y" Blood Bank and an Advance Depot Medical Stores were also sited in Venraij medical area. Air evacuation was arranged from airstrip B100 at Hees (E8934), and 35 Casualty Clearing Station moved forward to this location. Ambulance evacuation from Corps medical installations west of the Rhine presented no problem as the Venraij hospital area was easily accessible from the main traffic routes across the River Maas. Ambulance railhead was established at Helmond on March 18, 1945 and was not moved forward to Horst Sevenum (E8216) adjoining the Venraij medical area until D-Day; this was done so as not to interfere with the petrol unloading and also for obvious security reasons.

For this operation, an officer was specially detailed as Army Casualty Evacuation Officer and made responsible for the co-ordination of all casualty evacuation by road, rail and air, from the Venraij area. Apart from the normal ambulance car allotment to Army of one ambulance car company for evacuation from Corps and within Army area, 21 Army Group made available to Second Army two further platoons of ambulance cars.

For rail evacuation, one ambulance train was to be available at ambulance railhead on D-Day, and thereafter two daily ambulance trains as long as required. However, air evacuation proved so successful that it soon became possible to cut down the number of ambulance trains; the average number of cases evacuated daily by air was over 400 and at times reached a figure of 600.

The area between the rivers had been very badly destroyed, and Corps were fortunate that there were just sufficient good buildings available for their needs, not all of them eminently suitable.

The siting of Corps Casualty Clearing Stations was closely supervised by the Army; in the north 30 Corps established its Casualty Clearing Stations at Bedburg (E9353) in magnificent buildings previously used as a lunatic asylum (and used by the Germans as a temporary military hospital); this site was later taken over by 77 General Hospital (600 beds). 12 Corps established its Casualty Clearing Stations at Schloss Wissen (E9536) near Weeze and also at Kapellen, and 33 Casualty Clearing Station moved to Geldern under command 8 Corps in the role of a surgical reserve to cover the southern crossings.

The assault was to be carried out by 12 and 30 Corps, who had all their

medical units between the rivers, while 8 Corps, who were to come in after the initial phase, had one CCS forward (as mentioned above) to act as an extra holding unit and to be in position ready for their Corps commitments later.

Planning for the assault was based on the lines of the training carried out by 8 Corps whilst grounded in the Seine area and the drill laid down as a result. This consisted essentially of a Beach Control Group, which in effect was a movement controlling agency for forwarding everything across in the correct sequence, whether unit, personnel, tpt or equipment.

It was a very highly organized body and contained representatives of every Branch and Service. As regards medical, it was so designed originally that it could deal with everything on both near and far banks, so that Division should not be impeded and lose its mobility by having to deal with casualties on the bank if it was going through, or forming a deep bridgehead. It also ensured continuity and prevented a hand-over supposing that more than one formation was crossing.

Each assault Corps was therefore allotted one Light Field Ambulance to organize and control the evacuation within the Bank Control Group area; these units were placed under command of the Bank Control Group and worked as an integral part of that formation. It was left to the discretion of DDsMS Corps to decide whether they used the medical resources of the Bank Control Group on the far bank or not; in fact one Corps did use a Light Field Ambulance on the far bank whereas the other Corps did not. As medical units of the holding divisions already covering the river line were fully established, the allotment of one Light Field Ambulance to each of the two Bank Control Groups proved adequate. A further Light Field Ambulance was placed under command 12 Corps for the First Commando Brigade, who had indisputable need of a complete medical unit for the assault on Wesel and their subsequent operations.

Permission had also been given by GOC 79 Armd Div for the improvisation of certain Buffaloes (amphibious tanks of the Mk IV type) to enable them to carry nine stretcher cases. The use of these amphibious craft, new to many, was a godsend and enabled large numbers of casualties to be brought back at a very early stage. With so many Buffaloes available there was really no need for these improvisations, as two or three stretcher cases can be conveyed in a Mk II or IV without any alteration, and in the circumstances this sufficed. However, the actual improvisations are also an aid to troops disembarking and it would be useful if they became a standard fitting.

One further addition was made to the Bank Group medical organization and that was the addition of Pioneers to act as stretcher-bearers. They were invaluable, whether sited at the Casualty Disembarkation Points or on the bank itself, where there had of necessity to be numerous parties to cover the whole area in case casualties actually occurred on the bank itself or were offloaded there from smaller craft such as the storm-boat ferries. This addition was on the lines of the original Beach Group organization and amounted in this case to one section of Pioneers to each Bank Control Group.

Finally, provision was made for casualty evacuation during operation

VARSITY, where careful medical planning was necessary to ensure that adequate hospital facilities were provided in Second Army area for U.S. troops. This was achieved by placing a platoon of a Field Hospital in the same accommodation as the forward Casualty Clearing Station in Kapellen. It would obviously be impossible to sort out casualties by nationalities on the far bank of the Rhine, and this arrangement ensured that US casualties could be "filtered" at Casualty Clearing Station level, transferred to the Field Hospital and thereafter evacuated through US channels. The allotment of amphibious transport to the medical services of the US forces was carefully watched and it was agreed that they should have an allotment of six DUKWS so that they could be preloaded with the central medical stores. Plans for evacuation of casualties from airborne medical units after the link-up with land forces were made the responsibility of the senior medical administrative officer of the formation who were likely to make first contact, and plans made by these officers for the collection of airborne casualties, especially the method and transport to be employed, were carefully checked to ensure that this commitment was fully covered. Annexure ('C') shows the lay-out of Army medical units immediately prior to the Rhine assault.

A bid for extra Jeeps and/or Weasels was also amply justified for officers employed in the vicinity of the banks.

From the medical aspect, the assault crossing of a big river is in fact a rather more difficult problem than an assault landing for the planning reason; in the latter all demands of medical units have obviously to be met. The invasion forces have to remain on shore *in toto* and adequate facilities must be provided to ensure the Medical Services adequate holding capacity from the first, and medical priorities are therefore high. In the assault crossing of a water obstacle it is obviously essential that the most careful consideration must be given to the priority claim of the fighting troops and their supporting vehicles for the use of assault bridges at the crossings, and wherever possible evacuation of casualties should be arranged by alternative means to avoid interrupting the bridge traffic. Provided that adequate ambulance transport is phased across the river for the evacuation of early casualties to CEPs, medical units may have to accept a slightly lower priority for their movement across the river than that normally given to medical units in an assault landing by sea.

Detailed planning for the phasing-in of medical units in the Rhine Assault was naturally carried out at Divisional level, whilst the medical organization for bank control and casualty evacuation from the west bank of the river was a Corps responsibility. The Medical Staff at Army Headquarters after outlining the evacuation policy, merely held a watching brief on plans of medical staffs at subordinate HQs, and examined in detail the Divisional and Corps Medical plans at a joint conference prior to D-Day; medical staff of Ninth US Army and the XVIII US Airborne Corps co-operated in this conference.

Plans had also to be made for the advance from the Rhine; from the medical aspect the advance from the Rhine presented a very different prospect from that of the pursuit into Belgium. In the first place, though the enemy

was partially disorganized, he was now fighting in his homeland, and his resistance though scattered would probably be in greater strength than had been encountered after the previous breakthrough. This meant that the Medical Services had therefore to be prepared for casualties in varying numbers throughout the time of the advance. Moreover British casualties could not be evacuated direct to civil hospitals as had been done in Belgium and France. The German civil hospitals were known to be overcrowded with both military and civil casualties. Provision had also to be made for medical supervision of German Military and Civil Hospitals overrun during the advance from the Rhine Bridgehead, and to provide medical attention for Allied ex-prisoners of war liberated during the advance. Finally, it was obvious that a reserve of Army medical resources would be required to assist Military Government in meeting unexpected demands that proved beyond the capacity of their own slender medical resources.

To deal with the situation in Germany there was not any shortage of installations, but to prevent any wastage of units it was essential to have a co-ordinated Army plan. This was particularly necessary as in the early stage the advance was to be along a comparatively narrow corridor before it fanned out.

A factor which added somewhat to the difficulty of formulating a medical plan was the fact that the advance was to be a staggered one on four axes with the right well forward and the left held back as a protective flank. It was certainly not realized at the time the medical plan was made how difficult this would render evacuation of casualties, particularly air evacuation. The main difficulty was foreseen to be that of ambulance transport to cover the long L of C, and DDsMS Corps were instructed to be prepared to hold cases and if necessary increase the holding capacity of Casualty Clearing Stations.

DDsMS Corps readily agreed to the Army plan, which was based on the supposition that while in the narrow corridor Casualty Clearing Stations could advance one up, but as the front expanded two up or more would certainly become necessary.

Initially three platoons of three-ton lorries were allotted permanently to medical who took them under operational control for the movement of the medical units, Casualty Clearing Stations and 200-bed General Hospitals.

The locations selected by Army for establishing CCSs and 200-bedded General Hospitals are listed below: those which in fact were utilized show the unit and date of opening in the planned location. Corps DDsMS were asked to site any Advanced Surgical Centres they formed at these locations for ease of hand-over.

Area Borken V3962* (34 CCS on March 29, 1945).

Area Ahaus V5087* (23 CCS on March 31, 1945).

Area Rheine V8009* (81 General Hospital and 35 CCS on April 4, 1945,
25 General Hospital (600 beds) on April 13, 1945).

Area Bramsche W1724.

Area Diepholz W4347* (24 CCS on April 9, 1945).

Area Nienburg W9950.

Area Bremen W7398 (not used by British troops).

Area Soltau X4289* (23 CCS on April 25, 1945).

Area Hamburg* (84 General Hospital on May 9, 1945).

200-bed General Hospitals were again, for a time, to take on the role of Casualty Clearing Stations. 600-bed General Hospitals were to follow up closely, and the speed with which they were made available by 21 Army Group was greatly appreciated.

To augment the medical resources of Second Army to meet the probable commitments for the control of German Hospitals overrun and to provide for the medical needs of Allied ex-prisoners of war, 21 Army Group approved the recommendation from Second Army that the second Field Dressing Station which was ultimately destined to be withdrawn from each infantry division should be withdrawn from Divisions and placed under command Second Army before the breakdown from the Rhine bridgehead. This virtually gave Second Army an additional six Field Dressing Stations of which three were allotted to Corps (one each to 8, 12 and 30 Corps) to assist Corps Medical Services in their Eclipse commitments. 21 Army Group also made two additional Field Hygiene Sections available to Second Army; these were initially employed in camps for Displaced Persons along the Rhine Barrier Zone.

In practice it was found that one Field Dressing Station could supervise from 5 to 12 German Military Hospitals (and civil hospitals with military wings) depending on their size and distances apart; Army Field Dressing Stations took over from Corps Field Dressing Stations as the advance progressed.

In providing hospital facilities for Allied ex-prisoners of war (excluding British, Dominion and United States) the policy was initially to utilize selected German civil hospitals (with their staffs working under British supervision). German staffs were later replaced by ex-prisoner of war medical personnel as they became available.

For the first week of operation *PLUNDER* Second Army was composed of five Corps XVIII US Airborne Corps, 8, 12, 30 Corps and 2 Cdn Corps, but the latter reverted under command First Canadian Army on April 1, 1945.

The assault was entirely successful in all sectors, although the opposition to 30 Corps in the Northern sector seemed to have been much stiffer than it was farther south.

The airborne drop was made in moderate to intense anti-aircraft fire without interference from enemy aircraft and was immediately followed by a resupply mission. By the late afternoon contact was made by both Airborne Divisions with elements of 15 (S) Division and casualties were in some cases being evacuated within six hours of the drop. By midnight evacuation was in full swing until some interference with the DUKW organization occurred. However, this we soon rectified and a large number of serious casualties of first priority got away.

The Commando crossing at Wesel went without a hitch and with few casualties. It had seemed probable that this would prove a difficult operation for the Medical Services owing to the nature of the operation. The crossing was to be made by Buffalo, well north of the town and the advance

then continued over difficult country to increase the element of surprise. No L of C was to be established between the crossing place and the town and the whole Bde was to curl its tail up in Wesel overnight. The position was to be clarified at first light, and after mopping up, communication was to be established with the west bank in the neighbourhood of the old road bridge.

To support the first stage, one section of 21 Lt Fd Amb had crossed with the leading elements of HW Commando and formed a CEP which was responsible for clearing all the ground up to the only lateral road running north from Wesel towards Xantem whilst another section formed a CDP on the west bank. When their task was accomplished these two sections returned across the river to the Unit HQ preparatory to forming the link on the west bank on the following day.

To clear any casualties that might occur *en route* to the town and to support the Bde in the town two further sections crossed with the Bde; one section went direct to the town and set up a CCP, whilst the second section, supported by one troop of 600 Rs, swept the area traversed for casualties, eventually joining the other section in Wesel.

The whole scheme worked well; casualties were not heavy and those occurring early were evacuated as intended to the CCP on the west bank at the original crossing site. Those occurring later were held and evacuated in daylight.

By the second day of the offensive 12 Corps were able to complete their bridging but 30 Corps were experiencing more difficulty in the north and it was not until the next day that the armour could be passed across. By this time, however, the bridgehead had been enlarged to a depth of 15 miles at Borken (A3962) and 8 Corps was moving forward to take over the right flank of Second Army, with under command 11 Armd Div, 1 Commando Bde, 6 Airborne Div, 6 Gds Armd Bde and later on 15 (S) Div.

(To be continued)

Clinical and Other Notes.

AMŒBOMA OR CARCINOMA OF THE HEPATIC COLON.

BY

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[Received January 1, 1947.]

It is now generally recognized that *Entamoeba histolytica* can produce a proliferative lesion—an amœboma—which can be very difficult to distinguish from a carcinoma. Much less commonly carcinoma can supervene in a large intestine already affected by the lesions of amœbiasis.

That this is a rare complication is shown by the fact that only one reference to this association has been found in the English medical journals (Morgan, 1944).

The following case is reported to show the difficulty of making a clinical diagnosis of carcinoma from amœboma when the past history of amœbiasis is strong, even though that infection occurred forty years previously. Further we wish to open the possibility of carcinoma of the colon supervening on old and possibly healed amœbic lesions.

A. M. B., aged 65 years.

The patient was always healthy in his youth and never came under medical care until, on entering the Army at the age of 17, he participated in the South African campaign, being wounded in the chest and left leg.

When 22 he proceeded to India, and shortly after arrival began to suffer from chronic ill-health which was only diagnosed after many months as due to amœbiasis. By then he was having severe pain in the right chest and he was evacuated home, aged 23, with a large liver abscess. On arrival in U.K. the abscess was drained by open operation and 57 oz. of pus obtained. During the next three years three further liver abscesses were drained. He was then invalided from the Army.

When aged 31 the duodenal ulcer from which he had suffered for some time perforated and was sutured. Three years later he suffered another perforation and on this occasion a gastro-enterostomy was performed as well as closure of the perforation.

After this the patient had several laparotomies for the division of adhesions producing acute intestinal obstruction.

At the age of 50 the patient developed a further attack of acute obstruction, this time due to a strangulated inguinal hernia, and following the operation he had several further attacks of obstruction, some treated by division of bands and some by gastric suction.

The patient remained in fair general health, undertaking a busy administrative post, and yachting at the week-ends, until January, 1945, when he was 64 years old. He was then forced to stop work by a severe dyspnoea on slight exertion, which had been growing worse for some six months. This was finally diagnosed as due to pernicious anæmia and the symptoms were greatly relieved by injections of liver extract.

By July, 1945, he was sufficiently well to proceed to Hamburg in the Control Commission Germany. Soon after his arrival he noted that, whereas he had for many years passed two stools each morning, he was now passing three or four looser stools, and suffering from considerable flatulence. Mucus was frequently present in the stools.

These symptoms continued and early in 1946 he noticed loss of weight and a

feeling of great fatigue during the week before he received his monthly injection of liver extract. In April, 1946, he noted a lump in the right upper abdomen. By June the lump had become more prominent and was painful and tender and he was admitted to a military hospital in Germany.

He was then pale and obviously wasted, with a visible and palpable tumour in the right hypochondrium. The blood-count showed Hb. 70 per cent and R.B.C. 4,170,000.

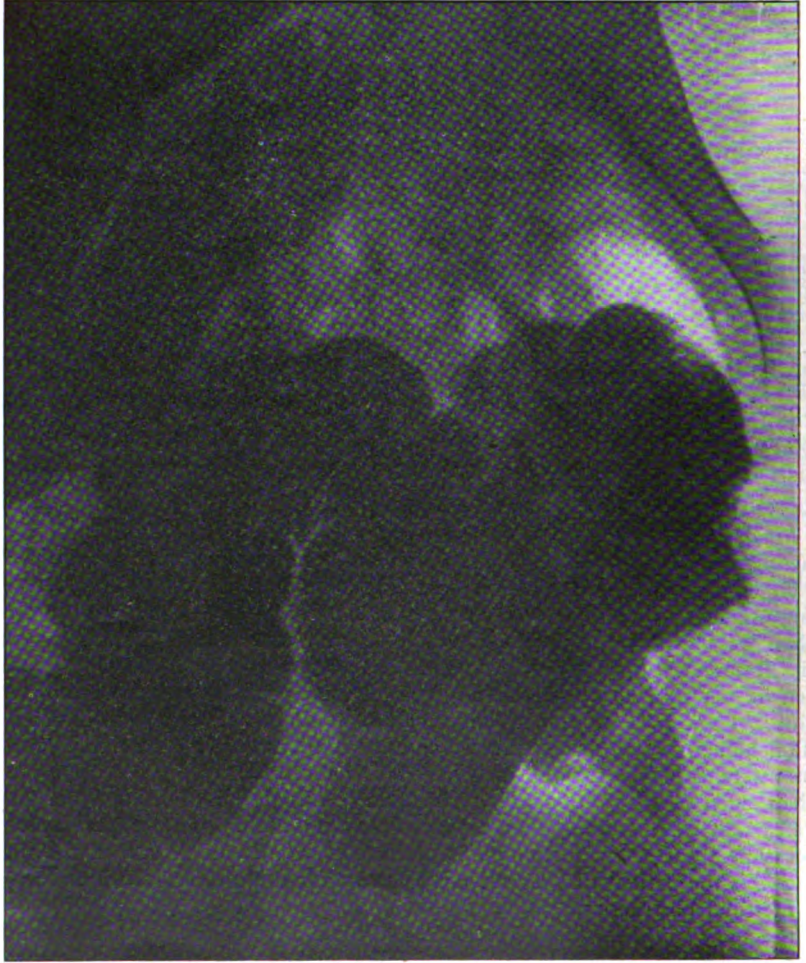


FIG. 1.—Barium enema to show the complex of the small and large bowel with barium entering into an abscess cavity in the liver substance. This we took to be the fixed filling defect.

The white count was 28,000, with a neutrophil leucocytosis of 25,000. The stools were normal.

Four pints of blood were given with marked symptomatic relief. A barium meal was reported as normal, but the barium enema showed clearly a filling defect of the hepatic flexure which was absolutely constant in shape throughout all films (*see fig. 1*).

A course of 10 gr. of emetine and one million units of penicillin was given; there was no demonstrable change in the characters of the lump.

The patient was then transferred to this hospital, being admitted on July 16, 1946.

On admission, the patient was pale and thin, looking his years but mentally alert and in good spirit. He was edentulous, with a clean moist tongue. The lungs were clinically normal, with a good air entry at the bases and the heart was normal in size with no added sounds; the B.P. was 110/80.

The abdominal wall was heavily scarred and very thin, allowing observation of peristalsis over most of the abdomen. There was no distension and no evidence of free fluid. There was an obvious lump lying on the right side of the abdomen, approximately two inches lateral to the umbilicus. It moved with respiration. Palpation revealed a tender liver to be a hand's breadth below the costal margin; its surface was smooth. The visible lump was attached to the lower margin of the liver. It was not movable independently of the liver. The lump was some three inches in diameter, very hard and



FIG. 2.—X-ray of chest to show the raised deformed liver.

moderately tender. No other viscera or lumps were felt in the abdomen. There was no enlargement of any lymph glands and rectal examination was normal.

The blood count on admission showed R.B.C. 3,000,000; Hb. 75 per cent = 12.0 grm. per cent, and W.B.C. 9,800 with 8,000 neutrophils. The E.S.R. = 45 mm. in first hour (Westergren). Examination of the stools revealed no abnormality and a sigmoidoscopy with microscopy of the mucus obtained was also negative.

A chest X-ray showed normal lung fields, with a scarred, peaked, raised and immobile right diaphragm (*see* fig. 2).

The impression at this time was that clinically the mass was malignant and attached to a very large liver. But there was a strong past history of amœbic hepatitis with abscess formation. The liver was very enlarged and its surface smooth.

The diaphragm was immobile, raised and deformed. There was an evening temperature of 99 to 100° with a pulse-rate of 90. He showed at his previous hospital a

leucocytosis with a high percentage of polymorphs. He was hæmolysing his red cells. How much of this mass and of this large liver was due to amœbic infection?

We tried a course of emetine again and there was not the slightest change in his physical signs or his temperature chart.

Therefore, on August 9, we proceeded to exploratory laparotomy with a pre-operative diagnosis of carcinoma of the hepatic flexure supervening on chronic inflammation secondary to amœbiasis and with abscess formation.

A slow transfusion of four pints of group B-III. blood was given during the forty-eight hours prior to operation. A Ryle's tube was passed into the stomach immediately prior to operation and suction maintained throughout.

Anæsthetic.—Nembutal 3 gr. was given orally two hours, and atropine 1/100 gr.



FIG. 3.—Photograph of the fixed specimen. from the R.A.M.College Museum. Note the glass rod extending through the fistulous opening of the transverse colon into the liver abscess cavity.

H.I. half an hour, before operation. Ephedrine 1½ gr. i.m. immediately prior to the spinal anæsthetic. This consisted of light nupercaine, 1:1,500, 12 c.c. injected in the L3-4 space by Howard Jones technique. Cyclopropane and oxygen were administered by closed circuit throughout the operation, the maximum depth of anæsthesia being the first plane of stage three. One pint of i.v. dextrose saline was given, followed by three pints of whole blood, during the operation. The condition of the patient throughout remained satisfactory, there being no significant change in the blood-pressure during the three and a half hours' operation.

Operation.—Directly over the mass a right upper transverse incision was made, with a vertical mid-line extension downwards. There was no free fluid. The liver was

enlarged a full hand's breadth below the costal margin, and there was adherent to its inferior aspect a large complex made up of terminal ileum, cæcum and ascending and transverse colon. The nature of this mass was slowly elucidated by the division of a vast number of adhesions and it was established that the whole hepatic flexure was adherent to the inferior aspect of the liver and that there was a carcinoma of the ascending colon, spreading directly to the adjacent and adherent transverse colon (*see* figs. 3 and 4). It was clear that a portion of the liver would have to be excised in order to free the colon.

As the patient's condition was good and no evidence of secondaries could be found in the liver, pelvis or lymph glands draining the area, excision was attempted. The whole complex of terminal ileum, cæcum and colon was mobilized and the adherent portion of liver cut away with diathermy. During this procedure, a sudden fæcal leak occurred and it was found that a liver abscess cavity communicating with the malignancy in the hepatic flexure had been entered. The fæcal matter was caught in packs and the excision of the specimen was completed. There was brisk hæmorrhage from the cut surface of the liver, which was controlled with a pack. A side-to-side ileo-transverse colostomy was performed and the wound closed in layers, with the liver pack left in situ.

The operation specimen consisted of the terminal ileum, cæcum, ascending and transverse colon and a portion of the liver abscess. The specimen is in the museum of the surgical department of the Royal Army Medical College who

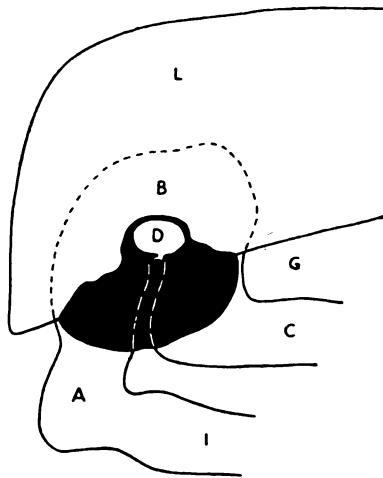


FIG. 4.—Line drawing to explain the photograph.

- A = Ascending colon and caecum.
- B = Hepatic flexur.
- C = Transverse colon.
- D = Abscess cavity.
- G = Area of Carcinomatous growth.
- L = Liver.
- I = Terminal ileum.

have kindly supplied the photograph of the fixed specimen (fig. 3). This is difficult to interpret and a line drawing (fig. 4) with the superimposed liver is added. These show a carcinoma of the hepatic flexure extending into the transverse colon. It had necrosed on the contiguous surfaces of the hepatic flexure and the transverse colon to form a fistula between the two. It had extended directly into the liver (D in fig. 4) and that cavity was continuous with the fistula in the hepatic flexure and the transverse colon.

In fig. 3 a glass rod leads from the fistulous opening in the transverse colon into the liver abscess and thence into the carcinoma in the hepatic flexure.

In view of these findings we reviewed the X-rays. What we took to be the constant filling defect was in fact barium in the abscess cavity. This is still seen in the film taken after evacuation (fig. 5).

Sections of the growth in the colon showed it to be a tubulo-adenocarcinoma, which appeared to have penetrated all coats of the bowel. Sections of the wall

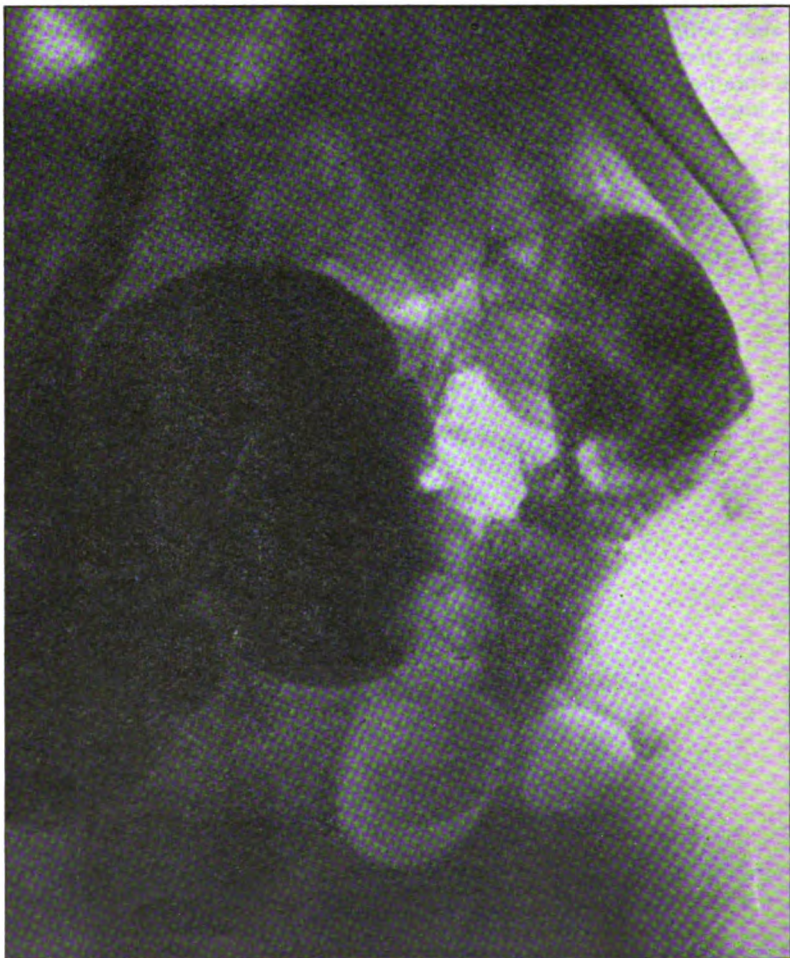


FIG. 5.—The X-ray appearances of the complex and the abscess cavity taken after evacuation.

of the liver abscess showed a metastatic mass of similar growth. This deposit appeared to have directly infiltrated the liver rather than to have spread via the lymphatics or blood-stream. The tumour was classified as Broder Group 2 —H. Spencer, Major, R.A.M.C., Demonstrator in Pathology, R.A.M.College.

Post-operatively the i.v. blood, followed by dextrose-saline, was continued

for seventy-two hours and gastric suction maintained for forty-eight hours. Four-hourly omnopon $1/3$ gr. was given. The patient made a satisfactory recovery from the operation and on August 15, 1946, the liver pack was removed under pentothal, without incident. On August 20, 1946, a fæcal fistula developed at the site of exit of the pack, but the general condition remained satisfactory.

The fæcal fistula only leaked a small amount of fæces, a good evacuation *per rectum* being secured by a daily enema. On September 4, 1946, the patient sat out of bed and from then steady progress was made until, on September 17, he complained of feeling tired and distended. Throughout September 18 the B.P. fell steadily and the pulse grew weaker, the patient sleeping for long periods. He died on September 19, 1946.

The post-mortem showed an inoffensive purulent peritoneal exudate which was presumably due to infection from the liver abscess which opens direct to the general peritoneum; so dense were the adhesions around the site of operation that no satisfactory dissection could be made.

Sections taken from the remaining portion of the wall of the liver abscess showed the presence of carcinomatous tissue. There was no evidence of amœbic infection of the liver.

DISCUSSION.

A case of carcinoma of the hepatic flexure extending into the liver to form an abscess cavity in that organ which abscess communicated directly with the lumen of the bowel is described. It also extended into transverse colon to form a fistula between the hepatic and transverse colon.

Forty years previously an amœbic abscess of the liver had been drained. He presented now not only with a hard lump attached to the liver but with a tender liver enlarged one hand's breadth, and with its surface smooth, associated with a high immobile deformed diaphragm, an evening pyrexia, a leucocytosis and looseness of the bowels with mucus in the stools. Amœbæ were not found nor were ulcers of the bowel wall seen with the sigmoidoscope.

Clinically the mass felt malignant. There was no clinical improvement first to emetine and penicillin and later to a further course of emetine. Therefore we made a pre-operative diagnosis of carcinoma of the colon. The persistent pyrexia and the large smooth tender liver prompted us to add that it probably supervened on chronic amœbic infection with abscess formation.

We found a carcinoma of the colon but the liver abscess was by virtue of a direct extension of the malignancy into the liver. This accounted for the pyrexia and the large tender liver. The raised and deformed diaphragm was probably the result of the amœbic infection forty years previously. The marked anæmia and the diarrhœa are the common features of carcinoma of the right bowel.

Is there any association of carcinoma and amœbiasis? A review of the comparatively scanty literature of this subject (*see references*) shows that there is a period when the symptoms are thought to be due to old amœbiasis. Such was the case with the present patient. But the clinical hardness of the mass

even in the presence of an unresolved pyrexia plus the failure of the therapeutic test with emetine clinched the diagnosis. It is, however, easy to visualize a patient in whom there is greater evidence of an amœboma, and it is the purpose of this paper to emphasize that carcinoma and amœbiasis can co-exist or follow one or the other. For chronic amœbiasis is likely to have long-standing ulcer or granulomata or polypi which are all precancerous.

SUMMARY.

A carcinoma of the hepatic flexure causing some confusion with amœboma is described.

Further examples occurring in ex-Service personnel are probable.

My thanks are due to Major Miss K. M. Watson, D.A., R.A.M.C., for an excellent anæsthetic during a long operation on a very ill man of 65. She also gave us the line drawing. This patient was under the excellent care of Captain P. Jones, R.A.M.C., who produced most of these notes and the references.

This article is submitted by permission of Colonel A. R. Oram, O.B.E., M.C., Officer Commanding this hospital.

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HYPOGLYCÆMIC RESPONSE TO GLUCOSE STIMULATION IN A CASE OF ADDISON'S DISEASE.

BY

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A CASE of Addison's disease came under our observation which offers some unusual clinical and biochemical features so that it is considered worth recording.

CASE HISTORY.

Pte. J. S., aged 20, was seen by one of us (A. E.) on November 19, 1946, on admission. He was transferred from a C.R.S. where he was under treatment for pharyngitis, and on getting up from his bed, suffered, what the medical officer suspected, a vaso-vagal syncope. He became giddy, pale, collapsed, the pulse-rate went down to 50 to recover only slowly. No blood-pressure reading was taken. He admitted that he had suffered from similar attacks three or four times every year ever since he had cerebrospinal fever in 1941. He also complained of a growing fatigue which started insidiously, and became noticeable during the last few months.

Regarding the cerebrospinal fever no notes are available but, according to the patient's story, he was very seriously ill in hospital and unconscious for two to three days.

Apart from this there is only history of diphtheria at the age of 7. No history of any gastro-intestinal disturbance could be elicited.

The family history reveals nothing of importance.

On examination.—A well-built lad, fairly well covered, rather quiet.. No clinical sign of anæmia. No enlarged glands, no clubbing. No abnormal pigmentation except on the lateral aspect of the right thigh where an area of *café-au-lait* colour of the size of a large palm was found.

Respiratory system: Clinically and radiologically N.A.D.

Cardiovascular system: Heart normal in size, heart sounds closed, rather faint. Pulse well filled, regular. Blood-pressure on the first reading was 120/80 in supine, and 110/90 in sitting-up position. In a series of blood-pressure readings made on admission and during the following days a postural change could always be demonstrated, and the drop in the blood-pressure on standing up from a supine position was as much as 30 mm. of mercury.

Abdomen: Tenderness on pressure in the right lumbocostal angle, otherwise N.A.D. C.N.S.: Nil abnormal detected.

X-ray of the renal region: No calcification seen.

Urine: N.A.D.

Blood-count: R.B.C. 5,100,000; Hb. 14 grm. per cent; W.B.C. 8,000 (polymorphs, 60%, lymphocytes 36%, monocytes 3%, eosinophiles 1%).

Blood urea: 30 mg. per cent.

In view of the marked postural change in the blood-pressure and the pigmentation found, the possibility of Addison's disease has been considered and one of us (L. R. S. McF.) was called in for consultation.

BIOCHEMICAL TESTS.

The blood NaCl content was first determined and found to be 280 mg./100 c.c. (normal 450-500). This result seemed to justify the tentative diagnosis, and the water test, as described by Rotman, Power and Kepler was carried out. The result was inconclusive, some abnormality of the water excretion was found. The quantity of any of the hourly specimens of urine passed after drinking 9 c.c. of water per lb. body-weight did not exceed the total output during the preceding twelve hours.

In the glucose tolerance test the fasting blood sugar was 130 mg./100 c.c., and the BS level rose to 180 mg./100 c.c. ninety minutes after 50 grm. of glucose were given. At 120 minutes the BS fell to 50 mg./100 c.c. and remained stationary at this level until the end of the test at 180 minutes. At 120 minutes the patient had a marked hypoglycæmic attack which lasted for two hours.

The test was repeated after a week of extra salt, and the corresponding BS values were: 50 mg., 75 mg., 50 mg., 45 mg., 40 mg., 43 mg. This time the hypoglycæmic symptoms were not so marked but there was some weakness and marked perspiration.

In the adrenaline test, recommended by Zondek, the fasting blood sugar was 85 mg./100 c.c., and, after the subcutaneous injection of 10 minims of adrenaline, the BS rose to 90 mg./100 c.c. only.

At this stage it has been decided to carry out the Cutler test to clinch the diagnosis. After forty hours of low salt diet the urinary NaCl output was

found to be 580 mg./100 c.c. It is said that values over 225 mg., under the conditions of the test, are pathognostic for Addison's disease.

DISCUSSION.

This case offers some unusual features. From the symptoms listed by Addison ("anæmia, general languor and debility, remarkable feebleness of the heart's action, irritability of the stomach, and a peculiar change in the colour of the skin") only the asthenia and the pigmentation are present, and even the latter is not found on its usual sites, the mucous membrane of the mouth, the lips or the hands. The blood-pressure is normal in the supine position, but there is marked postular change which is said to occur only in Addison's disease and in a bilateral lumbar sympathetic lesion.

Zondek refers to cases of Addison's disease bordering the "vagotonia" syndrome of Eppinger, and the clinical picture of our case is almost indistinguishable from a vaso-vagal debility.

It is well known that hypoglycæmic conditions on carbohydrate stimulation occur in cases of hyperplasia or tumours of the islets of Langerhans. This condition is called hyperinsulinism. In the glucose tolerance test a small rise in the blood sugar is registered on the ingestion of glucose, and, on the carbohydrate stimulus the blood-sugar level sinks to very low values.

It appears that, in Addison's disease, hypoglycæmic attacks during the test are uncommon, and the blood-sugar figures in our case clearly indicate that the result is not due to any excessive production of insulin.

In the first test the fasting blood sugar was found to be at the upper limit of normal, and the rise during the first phase was also quite physiological. This again resulted in the physiological *hyperglycæmic* response, i.e. the release of insulin. It seems that, in the case under discussion, the second correcting mechanism, the *hypoglycæmic* response, is absent, and thus the action of the insulin remains unchecked.

Physiologically the hypoglycæmic response consists of the release of adrenaline which restores the blood-sugar level by mobilizing the glycogen stores of the body, mainly in the liver. However the injection of adrenaline did not produce any appreciable rise in the blood sugar, and it is to be assumed that, in our case of Addison's disease, either the body glycogen stores are depleted, or else that the rapid conversion of glycogen into sugar can no longer take place owing to the lack of the suprarenal hormone.

Regarding the pathogenesis of the case we assume that the original lesion of the suprarenals occurred during the cerebrospinal fever in 1941, and that the subsequent fibrosis in the gland causes the increasing deficiency symptoms.

For some inexplicable reason most of the major functions of the suprarenal hormone remained yet unaffected, and the deficiency symptoms are restricted to a weakness of the lumbar sympathetic and of a disturbance of the carbohydrate metabolism.

SUMMARY.

A case of Addison's disease is described which mainly presents the clinical features of a vaso-vagal syncope. During the glucose tolerance test the patient's

blood sugar fell from 180 mg./100 c.c. to 50 mg./100 c.c. within thirty minutes and a marked hypoglycæmic attack was observed. The low blood sodium chloride level together with the abnormal high urinary sodium chloride excretion on low salt diet established the diagnosis.

Our thanks are due to Colonel G. D. Gripper, commanding York Military Hospital, and to Major-General E. A. Sutton, *C.B.E., M.C., K.H.S., D.D.M.S.*, Northern Command, for permission to submit the case.

ENTEROGENOUS CYANOSIS.¹

BY

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DEFINITION.

By enterogenous cyanosis is meant an abnormal dark coloration of the skin and mucous membranes in a patient with normal cardiovascular and respiratory systems who is not suffering from polycythæmia. It is due to the appearance in the blood of the abnormal pigments methæmoglobin and/or sulphæmoglobin. These pigments are entirely intra-corpuscular and therefore Fairley [1] has suggested the use of the terms "methæmoglobincythæmia" and "sulphæmoglobincythæmia" as being better than the more usually applied methæmoglobinæmia and sulphæmoglobinæmia.

ÆTIOLOGY.

Before the advent of the sulphonamide series of drugs enterogenous cyanosis was a comparatively rare event, though this might be because it was not recognized as such. It was sometimes seen amongst workers in the aniline dye and explosives industries, due to the inhalation or absorption through the skin or gut of coal-tar derivatives such as aniline, nitrobenzene and nitrophenols. Other cases were found to be due to the taking of certain drugs such as acetanilide, phenacetin and antipyrin (phenazone) which are common constituents of "headache powders," also nitrites, chlorates, sulphonal, trional and plasmoguin. Many of the patients exhibited marked idiosyncrasy to these drugs whilst others could tolerate large doses with only slight changes in the blood pigments. A small group of cases in which the foregoing factors were not operative was labelled "idiopathic enterogenous cyanosis" and several interesting observations were made in that connexion which will be mentioned later. By far the commonest cause at the present time is the exhibition of one or other of the sulphonamide series of drugs, and it has been found that in order of decreasing incidence of cyanosis we may put sulphanilamide, sulphapyridine and sulphathiazole [2].

¹A paper read at a conference of Southern Army pathologists held at the C.M.P. Laboratory, Poona, India, in September, 1945.

PATHOLOGY.

Hæmoglobin, so far as we know [2, 3, 4], is a combination of a simple protein of the histone group called globin, and a substance called hæm which is a porphyrin containing iron in its molecule (porphyrin being essentially composed of four pyrrol rings joined together), i.e. a metalloporphyrin. The amount of iron is 0.33 per cent and this corresponds to four atoms of iron per molecule, according to its molecular weight. One gram of hæmoglobin will unite with 1.34 c.c. of oxygen, and this is exactly the molecular ratio of 1:1. So we may write an equation for its combination with oxygen as follows:—



If we let "por" represent the porphyrin group $\text{C}_{20}\text{H}_{22}\text{N}_4\text{O}_4$, we can represent the composition of oxyhæmoglobin as $(\text{Por} : \text{Fe}^{++})\text{O}_2$: globin and on this analogy methæmoglobin can be written $(\text{Por} : \text{Fe}^{+++}\text{OH})$: globin or $\text{Hb}(\text{FeOH})$. That is, the oxygen content of methæmoglobin is only half that of oxyhæmoglobin and its iron is in the ferric state. More simply we may write HbO_2 for oxyhæmoglobin and HbOH for methæmoglobin, Hb being reduced hæmoglobin. The oxygen of HbOH is situated at a different position in the molecule from that of HbO_2 and does not come off when exposed to a vacuum and is useless for respiratory purposes. When the capillary blood contains 5 grm. or more of reduced hæmoglobin per 100 c.c., then cyanosis will be evident in the patient, but as far as the abnormal pigments are concerned, colour changes are noticed when the concentration is somewhat lower according to the results of some workers, probably because they are darker in colour than Hb .

A group of cases was mentioned earlier called "idiopathic enterogenous cyanosis" in which no history of exposure to industrial poisons or of drug-taking was forthcoming, some being familial in type.

Mackenzie-Wallis [5] found that the serum of certain of these patients contained a strong reducing substance of unknown composition which could produce the spectrum of reduced hæmoglobin if added to normal whole blood [3a]. This same substance was also present in the saliva and urine. He discovered an organism in the saliva which was capable of forming nitrites from amino-acids, a so-called "nitrosobacillus." Garrod [6] found a similar organism in the fæces of two patients and cure resulted after giving a vaccine of the organism. Apparently the reducing properties of the bacillus accelerated the production of HbOH , and also of sulphæmoglobin from sulphuretted hydrogen produced in the large gut by constipation. It was noticed that some patients were more susceptible than others and that the tendency was increased by giving saline purges such as magnesium sulphate. It was thought that the sulphur was to blame, but the sulphur ion is almost inert in the body and it is now put down to the fact that when the colonic contents are kept fluid, there is more putrefaction and therefore more H_2S production. It is well known that in acute poisoning with hydrogen sulphide that sulphæmoglobincythæmia does not occur, and the theory was postulated that the erythrocytes become activated in some way, thereby forming more easily the abnormal pigments. Whether HbOH or sulphæmoglobin is formed seems quite fortuitous, though the production of the latter depends on the presence in the blood of minute

traces of H_2S in conjunction with a drug, drug product or "toxin," the latter often being of intestinal origin. $HbOH$ is the commoner pigment, e.g. in a series of 117 cases of enterogenous cyanosis Bensley found 114 had $HbOH$ and only 3 had sulphæmoglobin [7]. In severe cases, methæmoglobinuria can occur but sulphæmoglobinuria has not so far been described. Experimentally it has been found that the feeding of sulphur to splenectomized dogs gives rise to sulphæmoglobincythæmia, but it has not been decided whether splenic dysfunction plays any part in the idiopathic form of the disease in man [8].

It was found quite early in the use of sulphonamides that some patients developed cyanosis [9], and much controversy raged as to the cause. Some thought that on account of the stated lack of correlation between degree of cyanosis and blood level of the drug [10, 11, 12, 13] and in some cases lack of demonstration of abnormal circulating pigments, that the cyanosis was due to actual coloured compounds of sulphanilamide produced *in vivo* [10, 11, 12]. This, however, has been shown not to be so, for $HbOH$ has been found in every case of cyanosis [14] and in most cases who were receiving a dosage of sulphanilamide of 0.1 grm./kg. body-weight/24 hours or more, though there was marked variation in the rate of onset and degree [15]. Moreover, Wendel states that methæmoglobinæmia occurs in all cases having a blood level of more than 4 mg./100 c.c. [16]. Some workers have found that a considerable percentage, as much as 30, of the functionally active hæmoglobin may be affected and thus rendered useless for respiratory purposes [17]. Harris [18] found that sulphanilamide cannot function as an oxidizing agent on hæmoglobin *in vitro*, but an oxidizing agent is formed when the drug reacts with the tissues, which can form $HbOH$. Sulphanilamide can catalyse the reaction between hydrogen sulphide and hæmoglobin *in vitro* [19] and there is no reason to suppose that this cannot occur *in vivo*.

SIGNS AND SYMPTOMS.

A patient who is "cyanosed" in the absence of polycythæmia, heart disease or respiratory disease, especially if giving a history of drug-taking, exposure to the industrial risks mentioned earlier or who is being treated with sulphonamides should be suspected of having methæmoglobincythæmia. To these I would add pamaquin which is perhaps a more common cause than is generally believed. The patient is usually constipated and lethargic and often mentally depressed, otherwise shows none of the dyspnœa associated with cyanosis due to anoxia because, of course, his arterial oxygen tension is normal. The cyanosis of methæmoglobincythæmia may be described as brownish, whilst that of sulphæmoglobincythæmia is said to be of a mauve or leaden hue. The former disappears in forty-eight hours if the drug is withdrawn but the latter persists for several weeks. The only true diagnosis is, however, by means of spectroscopic examination of the blood.

DIAGNOSIS.

Spectroscopic examination of the blood may be attempted *in vivo* utilizing the web of the thumb or the lobe of the ear, but it is more satisfactory to take some venous blood and lake it with water to make an initial dilution of 1:5.

This is examined spectroscopically (the pocket type of instrument does quite well) in a thickness of about 2 cm., and diluted gradually until the spectral bands are visible. In a dilution of 1:5, 0.3 grm.HbOH/100 c.c. can be detected and 0.5 grm./100 c.c. of sulphæmoglobin in a dilution of 1 in 10 [20]. The bands of HbOH are four in number, but only the α band in the red at 6,300 Å can be seen because of overshadowing by HbO₂. Sulphæmoglobin has three bands, the band of which is at 6,180 Å, i.e. a little nearer the blue end of the spectrum.

Pigment	α	β	γ	δ
Oxyhæmoglobin	5,780	5,400	—	—
Reduced hæmoglobin	5,560	—	—	—
Methæmoglobin	6,300	5,780	5,400	5,000
Sulphæmoglobin	6,180	5,780	5,400	—

The differential diagnosis [20] between the two pigments is easy if you have a reversion spectroscope, for all that is done is to set the α bands of the patient's blood to coincide and compare with freshly prepared solutions of the appropriate pigments. There are, however, several simple chemical tests which distinguish between them. First, reducing agents remove the α band of HbOH in the red and produce the single diffuse band of Hb in the yellow-green. For this test one can use yellow ammonium sulphide, sodium hydrosulphite or Stokes's reagent. The latter consists of 3 per cent ferrous sulphate in 2 per cent tartaric acid, and for use 5 c.c. of it is taken and strong ammonia added until the precipitate just redissolves. The resulting solution contains ammonium ferrotartrate, which is a reducing reagent; it must be made up freshly. Sulphæmoglobin is not affected by reducing agents. Secondly, HbOH is converted into alkaline HbOH on the addition of ammonia and the α band disappears. Again, sulphæmoglobin is unaffected. Thirdly, a few drops of 1 per cent KCN rapidly convert HbOH into cyanhæmoglobin whereas in the case of sulphæmoglobin the change takes several hours; its spectrum closely resembles that of Hb. Lastly, carbon monoxide shifts the α band of sulphæmoglobin towards the violet end whilst leaving HbOH unchanged. The two pigments can be prepared for comparison as follows [20]:—

(1) Methæmoglobin: Take 10 c.c. of 1 per cent whole blood and add a small knife-point of powdered potassium ferricyanide crystals.

(2) Sulphæmoglobin: To 10 c.c. of 1 per cent whole blood add 0.1 c.c. of 0.1 per cent aqueous solution of phenylhydrazine hydrochloride and one drop of a saturated solution of H₂S in water.

TREATMENT AND PROGNOSIS.

As far as idiopathic enterogenous cyanosis is concerned treatment seems to be of little avail; though the "cure" of cases of familial type through the continuous administration of ascorbic acid has been reported [21]. If a nitrosobacillus is found, then a vaccine of the organism should be tried [6]. Cases due to industrial poisoning or drug-taking will recover when the cause is removed. Cyanosis, unless very severe, is no indication for withdrawal of

sulphonamide drugs. No deaths have been reported even when therapy has continued during marked cyanosis. Hartmann *et al.* [15] have shown that the intravenous administration of 0.1 to 0.2 c.c. of a 1 per cent aqueous solution of methylene-blue/kg. body-weight causes disappearance of the cyanosis in half an hour. The circulating HbOH is quantitatively replaced by Hb which is released for respiratory purposes. Oral administration is also effective in about forty-eight hours. It can be conveniently administered in divided doses at the same time as the sulphonamide, to a total of 0.5 to 1.0 gm. per day [17]. A bowel washout before starting treatment may be of value in constipated subjects. There is now thought to be no danger in continuing with sulphur-containing foods such as eggs and onions in the diet [22] nor is sodium pentothal contra-indicated for anaesthesia.

SUMMARY.

Enterogenous cyanosis is due to the appearance in the erythrocytes of the abnormal pigments methæmoglobin and/or sulphæmoglobin. The commonest cause is sulphonamide therapy but the drug should not be withdrawn on that account. Other causes are certain industrial chemicals and the drugs contained in "headache powders." Pamaquin is not an uncommon cause in India. Some cases are idiopathic and, rarely, may be familial. A short account of the mechanism and diagnosis is given and an outline of treatment, which is rarely necessary, is described.

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Correspondence.

DEAR SIR,

May I be allowed to register a mild protest at the growing practice of using the letters "G.D.O." to connote a certain type of Medical Officer, a solecism which has even found its way into your own columns?

Hitherto, for most of us, a "G.D.O." has meant an Orderly belonging to the lowest form of R.A.M.C. life, to wit, a private soldier who, on emerging from the recruit stage, has not the brains or the industry to aspire to even a third-class trade qualification.

Formerly, we were all "Medical Officers"—Army Doctors if you like—and were described as such. Some of us were further classified with "(a)," "(b)" or "(c)," with a footnote to say we were also specialists in this, that or the other.

It was a commonplace in the ordinary course of duty for a Physician to open an abscess, a Surgeon to take a course in Map Reading or Military Law, a Pathologist to conduct a confinement, etc., etc.

In civil life, the line of demarcation between the Specialist and the G.P. is now almost complete: may the day be far distant before that unfortunate dichotomy becomes apparent in our Corps and before the failure to possess some special diploma stamps a man as belonging to "the lesser breeds without the Law."

I am, Sir,

Yours, etc.,

R. E. BARNSLEY.

Major-General (Retired).

Junior Army and Navy Club,

Horse Guards Avenue, S.W.1.

January 27, 1947.



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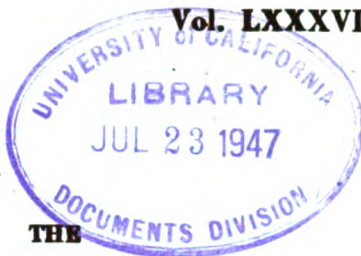


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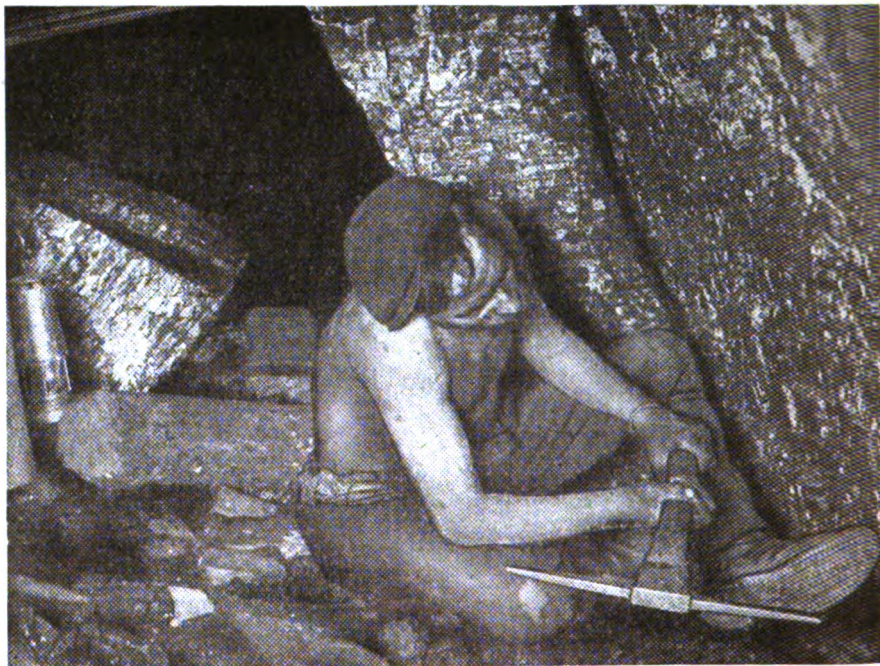
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AN OUTLINE OF THE ROLE OF THE MEDICAL SERVICES IN THE SECOND (BRITISH) ARMY'S CAMPAIGN IN NORTH-WEST EUROPE (1944-45).

Part III.

BY

Lieut.-Colonel R. GWYN EVANS, M.B.E., M.B., M.R.C.P.,

CHAPTER V.

THE ADVANCE THROUGH GERMANY TO THE BALTIC.

By the evening of the fifth day of the Rhine assault, the main bridgehead had been consolidated, and 8 Corps had passed over the river to complete its concentration on the east bank. Moreover, bridges had been secured to the south over the river Issel and Second Army began its advance eastwards into N.-W. Germany on a three Corps front, with 30 Corps to the north, 12 Corps in the centre and 18 Corps on the southern axis.

This advance was therefore very different from the previous pursuit in that on this occasion all three Corps were involved so that there were no reserves to call on; this was particularly so in the case of ambulance cars where in the earlier advance, the MAC of 8 Corps was available in addition to the normal allotment of Amb Cars Coys.

The tremendous asset afforded by casualty air evacuation was demonstrated only too forcibly during the first week of April when the opening of airfield B108 at Rheine was considerably delayed by enemy action. Unfortunately it was impossible for technical reasons to make use of any of the other four airfields in service east of the Rhine, and casualties had to be cleared from the General Hospitals at Rheine by road to Bedburg or even Venraij, a journey of some 80 to 90 miles over congested roads with the inevitable long delays at the Rhine crossings and their approaches. This raised the time for ambulance car

turn round to thirty-six hours; with this long evacuation route it was necessary to use 34 Casualty Clearing Station at Borken as a casualty staging centre for which role this unit expanded to provide accommodation for nearly 400 cases at a time.

Further forward, where the evacuation route from forward medical units in some sectors to the hospitals at Rheine now exceeded 100 miles, similar arrangements were made, utilizing a Field Dressing Station to establish casualty staging centre at Bohmte.

Casualty air evacuation from B108 at Rheine opened on April 10; and on April 14 from Diepholz B114 (24 Casualty Clearing Station acting as casualty air cushion). Particular attention had to be given to the ferrying forward by road of adequate replacements of stretchers and blankets, since the air freight bids at this time prevented the normal exchange of these items by returning casualty aircraft. Ambulance railhead moved forward to Bedburg (adjoining 77 General Hospital) on April 10, 1945.

"Y" Blood Bank and an Advanced Depot Medical Stores were established in the Rheine area. 13 Base Depot Medical Stores moved to the same area and opened on April 18, 1945. The Blood Bank later moved forward to Diepholz when air evacuation opened from B114.

On the right the 8 Corps' thrust developed rapidly and 12 Corps making moderate progress reached the River Weser at Hoya. Unfortunately progress in the 30 Corps sector was comparatively slow, and the Army medical plan was therefore amended and the proposed Casualty Clearing Station and Hospital sites at Bramsche and Nienburg were abandoned. Instead Uchte was temporarily used as a Casualty Clearing Station site to cover the Weser and a hospital area was established at Sulingen (7254) on April 15, 1945; initially this comprised 84 General Hospital which expanded to 350 beds, and was later augmented by the arrival of a second 200-bed General Hospital. Evacuation from Sulingen was by road to Diepholz, thence by air.

During the period April 17 to 23, a hospital area was established in Celle to cover casualty evacuation from the Elbe river line, and from the 12 Corps front to the north. 86 General Hospital (200 beds) opened in Celle on April 18, and 121 General Hospital (600 beds) opened five days later; evacuation was by air from B118 at Celle. 8 Advanced Depot Medical Stores and "Y" Blood Bank were also established in this area. Corps Casualty Clearing Stations were open at Bassum, Soltau and Luneburg.

By an advance from Celle 8 Corps probed up the main road towards Luneburg but met considerable opposition in the neighbourhood of Uelzen. Meanwhile 11 Armd Div swinging north through Winsen reached the Elbe both to the north and south of Luneburg.

During their advance from Celle, 8 Corps on April 15 had uncovered the Concentration Camp at Belsen. Warning had been given to 8 Corps that this Camp contained 1,500 cases of typhus but no indication had been given of the horrors that this camp contained.

A smaller combined prisoner of war and internee camp was later uncovered at Sandbostel in 30 Corps area; the internee camp was another concentration

camp which although in no way approaching the indescribable standards of Belsen nevertheless contained a large number of prisoners in the most horrible condition of starvation and disease (particularly pulmonary tuberculosis).

Meanwhile 12 Corps continued their advance to the Elbe and on April 16 reached a point two miles west of Soltau. On April 22 Buxtehunde, containing a big naval barracks, surrendered and Hamburg was invested.

At the same time 30 Corps holding Bremen from the south-west was directing 51 (H) Div to come in from the north-east. By midday on April 26 the centre of the town was in our hands and little opposition was encountered.

Guards Armd Div had meanwhile swung north-west and after stiff fighting completed the capture of Zeven on April 25. They now passed back to the command 30 Corps but continued on the same axis towards Bremervorde.

The problem of controlling large numbers of captured German hospitals (all holding small numbers of German military cases) increased as the advance progressed. It was decided to use the German military hospital (comprising some 2,000 beds) at Munster Lager as a Base hospital for prisoners of war. This hospital had its own railway siding and a captured German ambulance train was equipped, staffed and put into commission to run from Luneburg to Munster Lager; the hospital bed capacity was increased from 2,000 to 6,000 beds in ten days by the provision of medical staff, and stores from captured resources. Subsidiary Base hospital areas for prisoners of war were established west of the Elbe at Winsen (1,500 beds), Delmanhorst (1,500 beds), and Luneburg (1,200 beds). The total number of sick and wounded prisoners of war in German hospitals in the Army area amounted to 134,000 at the time of the Elbe assault.

The greatest care was taken to ensure that German military medical stores (which were now widely scattered and dispersed to minimize loss by Allied air attack) were promptly reported so that immediate steps could be taken to arrange for their collection into central dumps. Field medical units uncovering German medical stores collected these into small dumps, which were later centralized under Army control utilizing Captured Enemy Equipment Sections or Field Ambulances known to be well experienced in handling medical stores. Winsen (S6533) was selected for concentrating the medical stores of Wehrkreis Sanitatspark X, whilst stores from Wehrkreis Sanitatspark XI were collected together and formed into a central store at Bissendorf (X3738). Smaller dumps that had been collected in Vilsen and other areas were transferred to Celle to form a large dump for issue to Belsen camp, and to prisoner of war hospitals in the area; nearly 2,000 tons of German medical equipment were concentrated into Celle for sorting, storage and subsequent issue to German military hospitals and medical units, Allied ex-prisoner of war hospitals and concentration camp hospital areas.

To cover the 30 Corps attack on Bremen, and the subsequent clearing of the Cuxhaven peninsula 7 Canadian General Hospital moved to Bassum where it relieved 10 Casualty Clearing Station on May 2/3, 1945.

There remains little more to add to the tactical situation on 12 or 30 Corps front.

8 Corps on the other hand launched Operations ENTERPRISE and VOLCANO, the first an assault crossing of the River Elbe in conjunction with XVIII US Airborne Corps, which once again came under command Second Army, the second the break out of the bridgehead and an advance to the Baltic.

The assault was begun on April 29, 1945 and was a model crossing and despite slight scattered resistance went on at a good pace and the Baltic was reached on May 2.

XVIII US Airborne Corps, with 6 British Airborne Division under command commenced their attack on April 30, and crossed the river without opposition. Bridging (Class 40) was completed in a record time, and the build up on May 1 enabled the advance to commence on 3 axes. 6 (Br) Airborne Division reached the Baltic at Wismar and at 1200 hours on May 2 made contact with Russian forces advancing from the east.

For this phase a medical area had been built up in Luneburg consisting of both Corps and Army units, including 33 CCS and 81 General Hospital, 35 CCS moved up to establish a Casualty Air Evacuation Cushion at Luneburg airfield, and later 74 General Hospital (600 beds) and 9 Advance Depot Medical Stores also moved to Luneburg. With the arrival of 74 General Hospital 33 CCS were relieved and returned to 8 Corps, and finally 81 General Hospital were able to close and move forward.

Attaching at Annexures A, B and C, are sketch maps illustrating the lay-out of Army medical units at April 7, 14 and 24.

THE SURRENDER OF THE GERMAN FORCES.

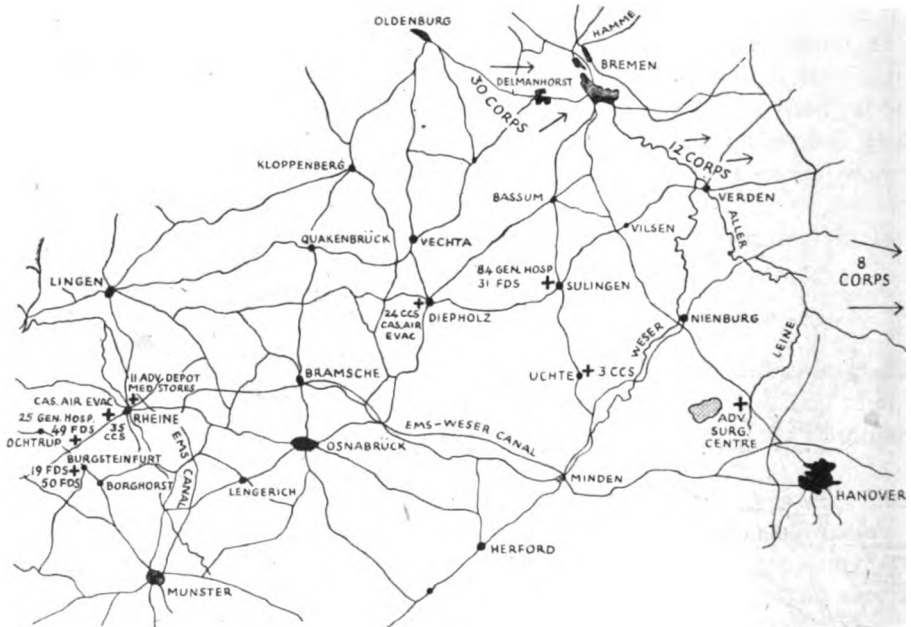
The German forces finally signed an act of unconditional surrender to Field-Marshal Montgomery at approximately 1805 hours, May 4, 1945, after the preliminary surrender of the port of Hamburg to the Second Army Commander on May 3, 1945.

This ended the war in N.-W. Europe and now began a period of intense activity to prevent a complete breakdown of any form of organization still existing in the German forces east of the Elbe. The refugee problem there was also completely chaotic and food was likely to run short in the very near future. It was also of paramount importance that the highest priority was given to returning to the land sufficient men to harvest the magnificent crops in production this year.

The surrender of the German Armed Forces considerably increased the problems confronting the Medical Services of the Second Army. German casualties from both Western and Eastern fronts had during the last two or three weeks of the fighting been evacuated to hospitals in Schleswig Holstein and Denmark. Furthermore convoys of German wounded were still arriving by sea from Kurland. German medical supplies were generally short and stocks of certain essential items were entirely exhausted. It was estimated that there were some 80,000 German sick and wounded in medical units in Schleswig Holstein, a further 60,000 in German hospitals in Denmark, and some 10,000 casualties already in transit by sea from the Eastern front. Clearly, the responsibility for arranging adequate medical care and attention for these casualties

former Senior Medical Officer to Rommel) was ordered to be represented at these conferences. Medical representatives of the German Navy and Luftwaffe were also summoned to attend one of the meetings so that a clear picture of the German Medical organization could be obtained. One meeting, the second of the series, was attended by the Director-General of Medical Services—General Oberstabsarzt Handloser, accompanied by his Chief of Medical Staff, hygiene and medical equipment officers. It was impressed upon General Handloser that it was of the utmost importance that all available information concerning the production and manufacture of pharmaceutical products and medical supplies be compiled without delay; great importance was also attached to the medical welfare problems especially the supply and fitting of artificial limbs.

ANNEXURE "B" TO CHAPTER V.



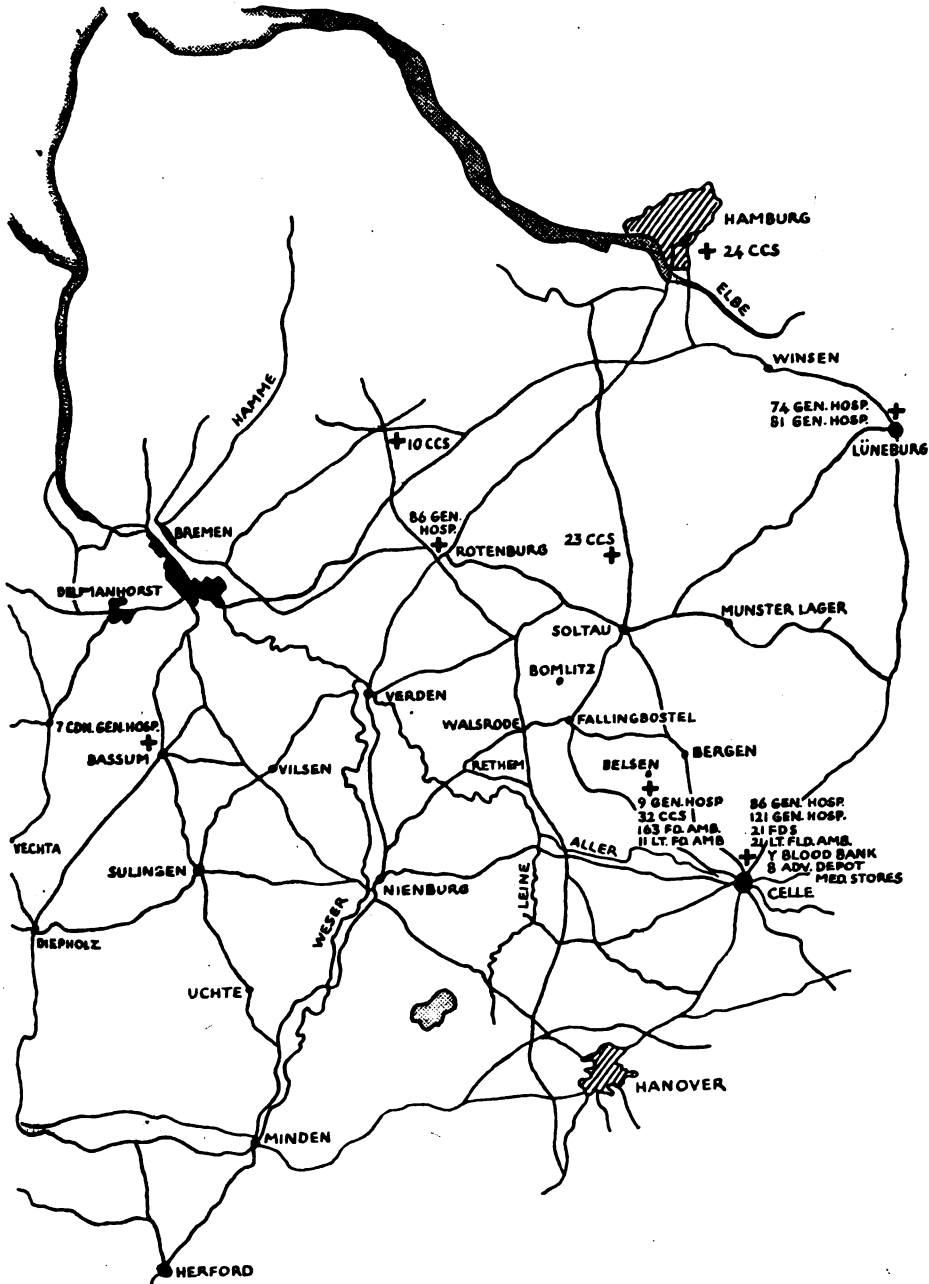
Locations as on April 15, 1945.

rehabilitation of limbless patients and the provision of adequate welfare and medical institutional care for helpless war casualties including the blind.

Whilst the problem of hospitalizing the vast numbers of German wounded was being dealt with, the redeployment of medical units of Second Army into the occupational "Corps Districts" was taking place in conformity with the general plan. In general this followed the original proposals of one large Military Hospital (600 to 1,200 beds), one smaller hospital (200-600 beds), one CCS, a Light Field Ambulance, two FDSs and three FSUs (to provide accessible emergency surgery) to each Corps District—1, 8 and 30 Corps.

The allocation of medical units to this end was of course largely dependent on the medical man-power situation governed as it was by the pressing need

ANNEXURE "C" TO CHAPTER V.



Locations as on April 23, 1945.

for return of the earlier release groups, and the large demand expected for RAMC personnel in later release groups to be transferred to the Far East.

Moreover provision had to be made for the four Infantry Divisions and two Armoured Divisions remaining operational to retain their full complement of medical units.

It was hoped to establish in each Corps District one 1,200-bedded General Hospital, two 600-bedded General Hospitals and one 200-bedded General Hospital (or CCS functioning as such). This was of course subject to local requirements, and obviously 30 Corps District required an initial increase on this scale, whereas 8 Corps District on the other hand did not require the full allotment of General Hospitals in addition to the two General Hospitals under command 8 Base Sub Area. Outlying areas were to be covered by the establishment of Camp Reception Stations as in the United Kingdom. It was anticipated that as demands for medical demobilization were met and demands for RAMC drafts fulfilled for the Far East it would gradually become necessary to amend the scale of medical units in non-operational Divisions to one Field Ambulance per Division, with the possibility of also retaining one Field Dressing Station per Division.

Advanced Depots Medical Stores were allotted, one to each Corps District and established near to the Corps railhead area. The requirements of medical evacuation were met initially by allocating one complete motor ambulance convoy and one platoon of an ambulance car company to each Corps District: as the motor ambulance convoys were withdrawn a partial replacement was planned using ambulance car company resources so as to provide each Corps District with the equivalent of 60 ambulance cars (excluding those held by medical units). German ambulance trains were allotted five to each Corps District, under control of the DDMS Corps; it was not proposed to allocate British ambulance trains to Corps Districts.

(1) GENERAL.

The campaign in North-West Europe provided the first experience in trying out the new Casualty Clearing Station (reorganized in July 1942) in large-scale operations. The new Casualty Clearing Station fulfilled its role adequately and although it had frequently been criticized as being too small, in practice by attaching two or three Field Surgical Units to a Casualty Clearing Station the additional tentage and 40 to 60 beds so provided easily overcame any shortage that might have been apparent; moreover experience showed that the size of the smaller Casualty Clearing Station was in every way adequate for its surgical potential, and any increase in its accommodation served no useful purpose unless there was a corresponding increase in its surgical potential. It was always possible to move a Casualty Clearing Station with one platoon of three-ton lorries and, even under the most trying conditions, Q staff were usually able to provide a platoon for moving Casualty Clearing Stations whereas a larger bid for transport would have been rejected owing to other heavy operational demands. The smaller amount of transport required to move the new

Casualty Clearing Station was, from the staff point of view, a definite asset and is a strong argument against any increase in the size of the unit.

The conversion of Casualty Clearing Stations from Corps Troops to Army Troops (though unpopular with the CCSs themselves) did not produce any material change. In practice it was always advisable to move Casualty Clearing Stations under command of the formations with whom they had previously worked, except on those occasions when an intra-Corps relief was proceeding and transport could be saved by leaving Casualty Clearing Stations in situ. Under these circumstances the CCSs passed under command of the relieving Corps; whenever possible they returned to their original Corps at the earliest opportunity.

(2) MOVEMENT OF CASUALTY CLEARING STATIONS.

It was invariably found that a Casualty Clearing Station with its full complement of Nursing Officers and carrying a proportion of reserve stretchers, blankets and medical stores (normally 500 stretchers, 1,500 blankets and 1 ton of medical stores), together with reserve rations and hospital supplies required a full platoon of three-ton lorries for movement.

(3) LAY-OUT OF CASUALTY CLEARING STATION.

Lay-out of tented Casualty Clearing Stations varied greatly in the early stages of the campaign, many CCSs adopted the policy of dispersal (as a protection against air attack, shelling and possible fire); this, however, was soon discarded in favour of more centred lay-out which greatly facilitated internal working, in particular nursing.

The normal time taken for a Casualty Clearing Station to open in a tented site was between five and six hours, although it was possible for CCSs to receive patients in small numbers within two hours of arrival at selected site. On several occasions Casualty Clearing Stations took over sites previously occupied by Advanced Surgical Centres, and to simplify the move in and take over it was customary in planning to move a small advance party of the CCS with the Field Dressing Station which was to establish an Advance Surgical Centre; this advance party was then responsible for "pegging out" the CCS lay-out so that the subsequent take-over a few days later would thus be facilitated.

During the autumn and winter CCSs were accommodated in buildings, and under these circumstances usually required up to twelve hours before they could be fully established in a new site, although they were able to admit cases within four hours of arrival.

During peak battle periods, particularly the bridgehead, it was customary to open two Casualty Clearing Stations alongside each other; a Field Dressing Station or Light Field Ambulance was used to control admissions, screening the minor casualties and sick from the Casualty Clearing Stations and directing the more serious cases to whichever CCS was open. Admissions to the CCSs thus sited were alternated either on a time basis switching every twelve hours,

or on the basis of the number of casualties admitted depending on the flow of casualties. Examples of the successful use of such a filter are given below.

	<i>Admitted</i> Day A	<i>Admitted</i> Day B	<i>Admitted</i> Day C	<i>Admitted</i> Day E
"A" FDS	108	93	24	76
"B" FDS or Lt Fd Amb	666	182	108	244
CCSs	452	127	99	252

The employment of Casualty Clearing Station as the Army Casualty Air Evacuation Cushion has been dealt with separately in the account given of casualty air evacuations.

AUGMENTING CCS RESOURCES.

Field Surgical Units and Field Transfusion Units were normally allotted on a scale of five or six FSUs and two or three FTUs per Corps, and being completely mobile could readily be switched from one CCS to another and utilized to build up the surgical potential of a busy CCS during peak battle periods.

By attaching to a CCS three FSUs and two FTUs, not only could an expansion of 60 surgical beds thus be provided, but the total surgical resources of the unit were thereby increased from two to five surgical teams with adequate pre-operative resuscitation facilities. Under such conditions, however, it became apparent that there was a lack of trained nursing officers and transfusion orderlies to supervise post-operative resuscitation and transfusion, since the FTU personnel were fully committed with the pre-operative work for five surgical teams. To meet this need in part, three extra nursing officers were allotted to Corps, and selected nursing orderlies in each CCS were given further training in transfusion methods.

200-BED GENERAL HOSPITALS.

When sited singly, the capacity and specialist potential (limited as it was to one surgeon and one physician) proved to be inadequate to enable them to deal with reception of casualties evacuated from Corps area during battle periods. Even with a daily evacuation, the holding capacity of these hospitals was inadequate, and their surgical potential too small.

To overcome these difficulties the policy adopted was to site two 200-bed General Hospitals alongside each other, further augmenting their resources by opening a Field Dressing Station (100 to 120 beds) to act as a screen for admissions, by filtering off the minor sick and trivial casualties before passing on more serious cases to whichever hospital was receiving. Two FSUs were included in the scheme, one to each hospital, and frequently two special surgical teams one trained in neuro-surgery and the other in maxillo-facial work. In this way a potential of 500 to 600 beds was secured with six surgical teams including facilities for the first stages of special surgery as well.

For heavy static fighting in addition to the resources utilized above it was usually necessary to open a further 600-bed General Hospital moved forward from L of C.

SPECIAL CENTRES.

Further provision had to be made for special cases, including VD, infectious diseases and psychiatric cases. To meet this need it was usual to employ within the Army area a number of Field Dressing Stations with 80 to 100 beds and stretchers; in the case of VD and psychiatric treatment centres a specialist element was attached to the FDS concerned to organize and supervise the special treatment required.

THE ARMY CONVALESCENT DEPOT.

(1) *General*.—Excluding the pursuit phase from the Normandy Bridgehead into Belgium, Second Army was throughout the campaign allotted its own convalescent depot. The value of this cannot be overstated, and a material saving in man-power was affected by using the facilities that the convalescent depot afforded, the saving amounting to a reduction of 34 per cent in the total number of cases requiring evacuation to base hospitals L of C.

The depot was normally located near the Rear Army boundary where it was sited in close proximity to the FDS acting as Army Exhaustion Centre (the FDS staff assisting the Convalescent Depot in providing minor medical attention for convalescents) and to the Reinforcement Holding Units.

(2) *Object*.—The primary object of the Depot was to save man-power within the Army area.

A large percentage (approximately one-third) of the total cases admitted to forward medical units including CCSs and General Hospitals were suffering from minor wounds or short-term sickness requiring only five to ten days' hospital treatment; at the end of this period though fit for discharge inasmuch as they required no further treatment the majority of these cases were still not fit for discharge to the units for "full duty." Though an Army in the field is unable to carry "light duty men," it was found that selected cases of the type described above could be made fit in an Advanced Convalescent Depot in an average period of fourteen days and then returned to their units through the Reinforcement Group.

This Rehabilitation Scheme ensured:—

(a) A quick outlet whereby General Hospitals, CCSs and Army FDSs could conserve their beds for more serious cases including battle casualties.

(b) A saving of transport and man-hours otherwise wasted in evacuating convalescent light sick or minor wounded L of C installations.

(3) *Organization*.—As mentioned above the Convalescent Depot was normally sited adjoining an FDS, so that the medical staff of this FDS could assist in providing minor medical attention and dressings for the convalescents. In practice, as the Convalescent Depot was invariably sited near the Reinforcement Group (and Personnel Railhead) the FDS involved in this role was that acting as Army Exhaustion Centre, and by virtue of this fact a useful neighbour for the Convalescent Depot.

In addition the Army Venereal Disease Treatment Centre and minor infectious unit formed by a second FDS was seldom more than 10 to 15 miles from the Convalescent Depot.

Without outside assistance from an FDS, the Convalescent Depot as at present constituted is unable to deal with convalescents requiring minor attention and daily treatment of the "outpatient" type, nor can it deal properly with the medical boards and recategorization arising during convalescence.

(4) *Routine*.—After routine admission procedure had been completed and soldiers introduced to their Company Officer and NCOs, they were medically and dentally inspected and graded according to their physical condition, type of illness or injury and medical category. Arrangements were made for any necessary inoculations and for dental treatment. Convalescents were placed in one of three grades for rehabilitation and training, and if specially recommended were ordered as an "extra" (i) physiotherapy, (ii) special remedial training, or (iii) occupational therapy. Cases were re-examined at intervals of five to six days and their grades (for rehabilitation and training) altered as necessary.

On an average most cases passed the physical grade tests appropriate to their category at the end of their second week at the Depot; they were now in their correct medical category and after reclothing and re-equipping to scale were transferred to the Reinforcement Holding Unit. The great importance of keeping the convalescents fully occupied cannot be stressed too strongly, and full use was made of wireless sets, games rooms, ENSA shows, canteen facilities as well as more stimulating distractions such as lectures, discussion groups, topical talks and "Padre's Hours." The depot training was also supplemented by road work, cross-country runs, endurance training and "battle courses," route marches and "potted sports."

Capacity.—Normal capacity required was for 1,000 other ranks, with a small officers' wing accommodating 20 convalescent officers. During an advance this depot was designed to split into two equal sections providing a forward convalescent wing of 500 beds, and a rear wing of similar size which closed down and moved forward later with the Rear Army Railhead installations.

An analysis of 4,000 admissions to the convalescent depot showed that of this total, 1,474 cases were purely surgical and 2,171 were medical. 85 per cent cases were category A1 on discharge from the depot where they had an average length of stay of fourteen days. 14.5 per cent cases required special remedial exercises, but only 5 per cent cases required electrotherapy.

(To be continued.)

MEDICAL RESEARCH IN THE CANADIAN ARMY.

BY

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INTRODUCTION.

THE Armed Forces of Canada owe a great debt to the late Sir Frederick Banting. He was the parent of research in the Medical Services. Foreseeing the scientific implications of modern war he took the lead in mobilizing the medical research resources of Canada. By 1938 he had completed a personal survey of all the university and medical centres in the country. With characteristic vigour he immediately engaged in the problem of organizing medical research units to serve the needs of the R.C.A.F. His unremitting devotion to his task, until his lamented death while on active duty with the R.C.A.M.C., had pointed the way and others were quick to take up the burden. The R.C.N. organized naval medical research units which, like those of the R.C.A.F., were to make contributions so outstanding as abundantly to justify the faith of their creators.

The Canadian Army Medical Corps entered the war without any Medical Research Division. The strength of the peacetime army had been so drastically reduced that the Medical Corps was able to do little more than fulfil its administrative duties. As the Army achieved its hundredfold increase in personnel and the true nature of the war in which Canada was involved became more clearly defined, it was realized that the Medical Service would be required to advise and help in the solution of a host of problems arising out of the complex character of World War II.

Clear intimation of this came in August, 1942, when the Director-General of Medical Services was requested by the Minister of National Defence immediately to provide an organization drawn from the Medical Services of the Army and R.C.A.F., to assess the value of certain compact rations for the use of the Allied Nations in the field. Its immediate purpose was to provide important information for the Department of Supply and Catering of the Quartermaster-General. Its deeper significance involved a study of the characteristics of compact rations, which were to be used eventually on D-Day.

This field trial was conducted at Penobsquis, N.B. (1), in September, 1942. The results had far-reaching effects and led to important modifications in the compact rations of the U.S.A., Britain, India, Australia and Canada. The success of the test trial also stimulated the D.G.M.S. and his deputies to organize and establish a division of Research and Development at National Defence Headquarters. It was realized that close integration of the proposed Army

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Research Department with the National Research Council was essential. Accordingly, with the support of the President of the National Research Council, an Associate Committee on Army Medical Research of the National Research Council was formed in December, 1942. Immediately thereafter a new Assistant Medical Directorate, known as the Assistant Medical Directorate of Research and Development, was formed at D.G.M.S., at National Defence Headquarters.

ORGANIZATION.

On paper, the new sub-directorate consisted of an Assistant Director of Medical Services, a Deputy Assistant Director, an Executive Officer, 12 officers and 30 other ranks in addition to the clerical staff. A requisite feature was the flexibility of the organization. Officers and other ranks were attached for special jobs and then released for duty elsewhere. In all, 92 officers and 59 other ranks have served at some time on medical research projects. The administrative officers and certain specialists formed the core of the organization. This plan, with slight modifications, has worked effectively.

The National Research Council, through the Associate Committee on Army Medical Research, functions as an advisory and supervisory body to the research sub-directorate. The latter acts as an operative agency within the Army structure. It initiates projects, allocates personnel, supervises research activities and follows up the recommendations of the National Research Council in the appropriate Army Directorates. Through the Associate Committee it has been possible to allocate medical problems of military importance to civilian scientists for solution.

Projects requiring investigation are referred to the Associate Committee which allocates funds where necessary. The chairman of the Committee also sits on the National Research Council Co-ordinating Committee for Medical Research. This prevents duplication of effort in the research units of the three Armed Services.

When reports are received from the research groups they are edited at D.G.M.S. and passed to the Associate Committee on Army Medical Research for publication in its proceedings. Reports from field research teams, such as No. 1 R.C.A.M.C., in Europe and the Canadian Nutritional in Burma, are immediately published as advance (restricted) copies of the proceedings and distributed to appropriate branches of the Canadian and Allied armies. By this procedure the authors' rights are safeguarded in respect to later publication in medical journals, while the reports are made immediately available to accredited recipients.

In addition to disseminating information on Army medical research to our allies, the medical research department receives information on medical science from them. This is effected through liaison officers who serve in Washington and London and through the Canadian Medical Inter-service Intelligence Division. The officers entrusted with these duties have made exceptional contributions in promoting the closest co-operation between American Service organizations and D.G.M.S. Information from all sources is digested for circulation among the appropriate branches of the Army, both in Canada and Overseas.

The original documents are catalogued in the Central D.G.M.S. Library at N.D.H.Q.

SUMMARY OF PROJECTS UNDERTAKEN.

A brief description of the work undertaken in the battle zones and in Canada will now be given.

Field Units in Active Theatres of War.

By common agreement between N.D.H.Q. in Ottawa, and C.M.H.Q. in London, a research team composed of specially trained medical officers from Canada and Overseas was formed in 1943. The team, designated as No. 1 R.C.A.M.C. Research Unit, was composed of two sections: one investigating wound infections and one for the study of shock. It operated in Italy and North-West Europe from 1943 until V-E day. As a result of the painstaking and devoted studies which this team conducted in the battle zones some fifty valuable reports (2 to 46 incl.) enriched military medical literature.

In 1944 a second unit proceeded from N.D.H.Q. to the British 14th Army front at the request of the Indian Government. This unit carried with it an airborne mobile nutritional laboratory. Its subsequent reports (47 to 54 incl.) on the nutrition of British and Indian troops and Japanese Ps.o.W. won the unstinted praise of the Director of Medical Services of the theatre command. The unit was withdrawn to Canada for re-fitting and enlargement with a view to proceeding to the Western Pacific area on a new assignment. These plans, and also those for an additional team to be sent to the same area, were made obsolescent by the surrender of Japan.

In Canada.

A large number of medical research projects have been initiated since 1942. These fall into four main categories: Development, Surveys, Clinical Studies and Field Trials.

(1) DEVELOPMENT.—(a) *Night Vision*: Even before the medical research unit was formally constituted work was proceeding in conjunction with the R.C.A.F. on the problem of Night Vision. This enterprise led to the production of new apparatus which completely revolutionized the method of training and testing Army personnel in night vision (55 to 61 incl.). An ingenious and accurate calibrator for night vision testing units was produced and distributed to all night vision units in the U.K. and Canada. Some of these new methods have been incorporated in the training of U.K. and U.S. troops. Correlation with field training has been brought about, with an improvement in the selection of men for night work (62 to 65 incl.).

Seventeen night vision units were established in Canada and seven Overseas. Some 300,000 men have now received the Army demonstration and test for grading.

(b) *Tump-line*: The use of the tump-line and head strap for carrying loads was revived. After study of improved methods and adaptation, it was incorporated in the training of stretcher bearers and later in that of selected personnel of Canadian and U.K. troops (66 to 69 incl.). A motion picture showing the principles and applications of the tump-line was also produced.

(c) *Field Equipment*: Representatives of D.G.M.S. have co-operated with other Army and National Research Council Branches in the improvement of existing designs, or the production of new models, e.g. ambulances, stretcher carry on jeeps, new stretchers for winter and aerial warfare, field medical panniers, goggles, gliders, special clothing, hospital equipment, plastic casts, new type crutches, insecticides and insect repellents, etc. (70 to 88 incl.).

(d) *Motion Sickness Remedies*: In collaboration with the research divisions of the R.C.N. and R.C.A.F. much work was done by civilian and Army workers. The main contribution of workers associated with the Army was the selection of a barbiturate drug known under code as V.12 (89 to 106 incl.). Efforts to test this remedy were frequently disappointing, owing to unfavourable sea conditions. It is still under test on troopships. The results are very promising, but no remedy which is a hundred per cent effective has yet been found. It is, however, expected that as a result of the co-operative effort a very valuable remedy will soon be made available.

(e) *Instructional Film on Shock*: A co-operative effort of the research divisions of the three Services produced an instructional film on "Shock" which was widely distributed.

(f) *Strip Films*: In 1943 the D.G.M.S. sponsored the first strip film to be produced in Canada by the National Film Board. Through the loan of Army artists and other personnel a producing unit was established. This unit has since made a large number of instructional film strips for use by various Army directorates.

(g) *Penicillin*: The Medical Research Sub-Directorate was the agency used by the D.G.M.S. to explore the possibilities of large-scale production of penicillin in Canada. The first contacts with commercial firms and the preliminary appraisal of amount which would be required for the three armed Services was made through this channel.

(h) *Bacteriostatic Substances*: On the theory that spore-bearing organisms producing gas gangrene might be carried into wounds by the soldier's clothing, investigations were made into the possibility of treating such clothing with bacteriostatic agents. Workers at the National Research Council, the Dominion Department of Health and the University of Montreal carried out bacteriological and animal experiments to assess the efficacy of such methods. No suitable agents for the bacteriostatic treatment of clothing were discovered which could be used along with D.D.T. and anti-gas treatment of garments (107 to 121 incl.). Efforts were also made to discover if the bacteriostatic treatment of blankets would inhibit the spread of streptococcal diseases in hospital wards. As will be seen later other methods appeared to be more promising of good results.

(i) *Audiometric Apparatus*: At the Montreal General Hospital a project sponsored by the Associate Committee on Army Medical Research has resulted in the production of a new audiometer of outstanding performance, flexibility and accuracy (128 to 131 incl.). A medical officer and four technicians have received special training in the use of the apparatus. A full-scale programme

for aural rehabilitation of returning soldiers has been submitted to the D.G.M.S. and to the Department of Veterans Affairs (130).

(j) *Electrical Apparatus for Use in Neurosurgery*: With the co-operation of R.C.E.M.E., new types of electromyographs (131 to 132) and an instrument for measuring skin resistance (133) of very much improved design and performance were produced at the Montreal Neurological Institute. A number of R.C.A.M.C. officers have been trained in the use of these instruments. All of the Special Treatment Centres for Neurosurgery in Canada have been supplied with the electromyographs, which have been custom-built at the Montreal Neurological Institute.

(2) SURVEYS.—(a) *Sylvatic Plague*: Shortly after the entrance of Japan in the recent war, concern was expressed over the possible spread of bubonic plague from infected rodents to man. The danger area was thought to be the southern and western parts of Manitoba, Saskatchewan and Alberta. It was therefore arranged to send a field laboratory to the three prairie provinces to assess the danger which was fortunately found to be less serious than had been thought (134).

(b) *Carriers of Entamoeba histolytica*: It was known that some Canadian soldiers who had returned from the Italian theatre of war were suffering from *Entamoeba histolytica* infection. How serious a carrier problem this might be was not known. Two surveys were made which indicated that about 10 per cent of the men were carriers of the cyst forms (135 to 136). This is ten times the carrier rate among the Canadian population as a whole and is likely to be a matter of concern to the Department of Veterans Affairs. Later studies on the Hong Kong survivors showed a carrier rate of about 33 per cent.

(c) *Mosquito Survey*: The return from the Mediterranean of men, many of whom had contracted malaria, raised the question of possible spread of the disease in Canada. Parts of the country in earlier days had been malarious and it seemed desirable to conduct a country-wide survey of the mosquito population. This was done in surveys during 1944 and 1945, with the co-operation of the Department of Agriculture (137 to 138). The surveys proved that there are a number of zones in which potentially infectable mosquitoes exist but for a variety of reasons it is held to be unlikely that malaria will occur in this country by cross-infection through insect vectors.

(d) *Upper Respiratory Disease*: In the year 1942, a survey of the conditions at Camp Borden yielded results which justified the computation that between 500,000 and 1,000,000 man-days were being lost annually through upper respiratory disease in Canada alone (141 to 143 incl.). This huge wastage represented at least \$6,000,000 per annum cost to the taxpayer.

As a result of the survey new measures of camp hygiene and sanitation, including oiling of floors and wet sweeping, were introduced and enforced (144). The result of these measures can be said to be coincident at least with a large decrease in the sickness rate from streptococcal and other diseases of the upper respiratory tract. In addition experimental procedures with treated blankets and the prophylactic use of sulphadiazine were instituted but not adopted on a large scale (152, 254).

Studies on influenza and surveys of the tuberculosis rate in the Canadian Army were carried on from 1942 to 1945 (148 to 153 incl.).

(e) *Industrial Hygiene*: From time to time in co-operation with A.M.D.5 (Preventive Medicine and Hygiene) such hazards to health as dust in training camps or carbon monoxide in Army workshops and advice on the best way to overcome them were investigated (80, 145).

(f) *The Incidence of Anæmia in the C.W.A.C.*: A survey was carried out to ascertain if the various Army jobs in which women had so suddenly been placed were producing anæmia among personnel. The results were largely negative (155).

(g) *Foot Problems*: The soldier's foot always becomes an object of great interest and respect in time of war. Great wastage occurs, both at reception centres and later in training establishments, due to foot trouble. It occurred to Army consultants that it would be an excellent idea to attempt to correlate an accurate and detailed description of some thousands of feet taken at the reception centre level, with the subsequent history of the same feet in Army training. The task has proved to be formidable; but after a great deal of labour a survey has been completed which it is thought will be of considerable value to the Army (156 to 158 incl.). Out of this has also grown recommendations for an improved Army boot and an improved civilian shoe.

(h) *Rh Factor*: Since from 13 to 15 per cent of all white people are Rh negative it was theoretically possible that this percentage of soldiers could be rendered sensitive to Rh factor following one or more transfusions with Rh-positive blood. Certain serious and even fatal transfusion reactions occurring in men overseas raised the question as to how great a hazard was created by the increased use of whole blood in battle areas. No investigator of this problem had been able to give more than an approximate guess as to what percentage of such men would become Rh sensitive.

For these reasons and with the co-operation and encouragement of The Children's Memorial Hospital, Boston, Mass., and The Children's Hospital, Winnipeg, Man., arrangements were made for the training of an officer and assistants, in order that a thorough survey could be made of 1,000 returned men who had had one or more transfusions. The major military hospitals and Department of Veterans Affairs hospitals in Canada were visited. The results indicated that about 40 per cent of those men who were Rh negative have been rendered sensitive to Rh or closely related factors (159). This is a result of great importance since it far exceeds most of the prognostications. All of the sensitized soldiers have had their documents altered and have received a letter from the D.G.M.S. warning them never to receive a blood transfusion without having these findings taken into account. It may now be necessary to make a complete survey of all veterans who have received transfusions. Undoubtedly there are very serious civilian implications in the results of this study.

(i) *Psychiatric Problems*: Several surveys were carried on in an attempt to evaluate the "S" factor of the Pulhems Profile (122 to 127 incl.).

Investigations were also made into the civilian readjustment of soldiers

discharged for psychiatric reasons, and into the personal adjustment of C.W.A.C. personnel (122 to 127 incl.).

(j) *Questionnaires*: It is not yet the practice in the Canadian Army, as it is in the U.S. Army, to send observers to the combat areas to determine how well the soldier's personal equipment, apart from his weapons, stand up to operational conditions. It was therefore decided to enlist the aid of the Research Branch of the Directorate of Special Services in preparing questionnaires on the soldier's opinion of his clothing, rations, and the efficiency of the Medical Services, from the stretcher bearer to the hospitals. These questionnaires were then sent forward to casualty clearing stations and field hospitals where wounded officers questioned recently wounded men on the various items.

This information was critically analysed and forwarded to interested directorates for their information. An outstanding feature of the report was the high efficiency with which the R.C.A.M.C. functioned in the field (160 to 163 incl.).

(3) CLINICAL STUDIES.—(a) *Damage and the Convalescent State*: During the past three years the Associate Committee on Army Medical Research has been able to support important studies of a fundamental character at the Royal Victoria Hospital, Montreal. Here a strong group of civilian and Army workers have been investigating the metabolic changes which occur in the damaged (wounded) and convalescent subject. In addition to discoveries of a basic character (165 to 174 incl.) some important results of immediate practical application have come from this research team. The demonstration of the large loss of tissue protein which occurs after wounding and the need in the wounded and in the convalescent state to have adequate supplies of protein available in food immediately focused attention on military hospital diets and the procedures followed in military institutions. Surveys showed that diets calculated to supply the patient with over 4,000 calories and 150 grammes of protein *per diem*, in fact only supplied him with 2,000 calories and 50 to 75 grammes protein (175 to 179 incl.). This was due to underdrawing of supplies, wastage in cooking and unappetizing meals. Thus was explained the very considerable loss of weight in many wounded men.

Practical measures were at once taken to rectify the situation. A team was sent across Canada to all of the large military hospitals, pointing out the deficiencies and the reasons why it was so important that they should not be allowed to continue. Subsequent surveys showed that great improvement had resulted from this measure alone (177). Literature was distributed to all medical officers through the Services Journal giving the facts and the modern lessons in nutrition which had been learned since the war began (179).

At the same time, realizing that first-class protein was in short supply overseas, a project was planned with the co-operation of the National Research Council, Macdonald College and the Directorate of Supply and Catering (R.C.A.S.C.), for the development and production of a powdered, high protein milk supplement. This, with suitable flavourings, could be readily reconstituted with water into eminently satisfactory milk shakes (180 to 182). These

were very well received by overseas hospitals and thousands of pounds of this highly concentrated food was sent to England and the Continent.

(b) *Effort Syndrome*: The very great wastage of man-power due to Soldier's Heart, Disordered Action of the Heart or Effort Syndrome, which occurred during World War I, stimulated interest in this condition in the early days of World War II. It has proved not to have been nearly so common in the recent war although it was the cause of rejection of a sizeable number of men under the "S" grading in the Pulhems Profile at reception centres.

Because of its proven potential in causing military disability and because war reveals larger numbers of such casualties, a study of the condition was entrusted to the Departments of Physiology of McGill University and the University of Manitoba. In consequence, several detailed studies have been reported in the Proceedings of the Associate Committee on Army Medical Research (183 to 191 incl.). The mechanism (physiological and/or psychological) underlying the condition remains imperfectly understood but enough progress has been made to warrant continuance of the investigation in peacetime.

(c) *Traumatic Injury to the Nervous System*: Mention has already been made of the development of apparatus at the Montreal Neurological Institute for use at neurosurgical centres (133 to 135 incl.). In addition a noteworthy number of contributions have been made by the group of Army and civilian workers at the Montreal Neurological Institute.

The earlier reports provided important data bearing on the requirements in case selection for the safe evacuation by air of men suffering from brain injuries (164, 192 to 201 incl.). Later work, both at Montreal and at the University of Saskatchewan, has been directed to finding what physical and chemical changes occur in the wounded or concussed brain, and to studies on nerve healing and regeneration (202 to 215 incl.). These investigations are of a fundamental character and it is already evident that they have given valuable indications for future research which should be carried into the post-war period.

(d) *A Method of Measuring Blood Coagulability*: Another project with a peacetime application was the investigation conducted by the Department of Pathology of the Royal Victoria Hospital into methods of measuring the coagulability of blood. It was hoped in this way to provide a simple bedside method, which would indicate when a patient's blood coagulability had increased to levels predisposing to spontaneous post-operative venous thrombosis. Although earlier results were very favourable it was later found that temperature variations in the ambient air and other factors led to seriously misleading findings, although under carefully controlled laboratory conditions reliable results could be obtained (216, 217). As the discovery of a suitable and accurate bedside method continued to be elusive after several months of war it was decided to leave the problem until peacetime.

(e) *Studies on Fat Embolism*: At the Department of Physiology, Dalhousie University, studies have been undertaken in an endeavour to discover the cause of fat embolism and a method of protection against the fatal results of this condition. These are still incomplete (218).

(f) *Studies on Intra-Arterial Pentothal Sodium*: Reports from the field alleged that gangrene of the limb occasionally resulted from the accidental intra-arterial injection of pentothal sodium. Confirmation of this has not as yet been forthcoming in experiments on laboratory animals conducted at the Department of Pharmacology, Dalhousie University (219).

(g) *An Evaluation of the After-effects of Malnutrition and Disease in the Survivors of the Hong Kong Garrison*: This study has been planned by the Canadian Medical Officer in charge at Hong Kong, and consists of a follow-up on the physical status of nearly 1,400 men of the Canadian Army who endured severe privations in almost four years of prison life in the hands of the Japanese. Almost complete day-to-day medical documents of the survivors were prepared by the medical officers while in prison. It is improbable that such detailed information has ever before been collected on a large number of Canadian soldiers under conditions of extreme starvation. The project will of necessity continue for a long time but it cannot fail to be of the utmost importance in adding to our knowledge of the effects of malnutrition on man.

(4) FIELD TRIALS.—(a) *Nutritional Studies*: The nutritional research requirements of the Army are so vast, and the subject so complicated, that it can only be summarized under one head. It overflows the boundaries of development, surveys, clinical and field trials, just as it overflows the confines of the Army itself.

Mention has already been made of the fundamental work on "damage" and the convalescent state, the educational programme in Canada and the development of the Department of National Defence high protein milk shake for use in military hospitals. Overseas, Canadian Army Medical personnel carried on important surveys and very effective propaganda on hospital and regimental diets (220 to 228 incl.). The outstanding work of the Nutrition Team which accompanied the British 14th Army to Rangoon in the field while on loan to South-East Asia Command has already received notice (47 to 54 incl.). In addition to the Penobsquis Field Trial (1), medical officers served on ration trials at Prince Albert, Saskatchewan, in 1943-1944; in Colorado, Harvard and Florida in 1944 in close collaboration with U.S. scientists (229, 230, 252).

The nutritional needs of isolated garrisons led to the development of the hydroponic cultivation of vegetables and the field use of sprouted seeds at Goose Bay, Labrador (231 to 239 incl.). The interesting demonstration that unproductive northlands can be made to bloom is susceptible to a much wider application in peacetime.

An essential adjunct to field trials in nutrition is an efficient laboratory. In Burma a very complete airborne mobile laboratory was used. At Prince Albert mobile and stationary laboratories were set up in the field and at the base. Very important findings flowed from these field laboratories and these frequently stimulated further laboratory research in universities. A very good example was the discovery of ketosis in troops on certain compact rations at the Prince Albert trial in 1944 (240). This and other contributing results had

the effect of excluding pemmican when used alone as a possible ration in the field.

A less expected finding was the fact that several of the compact rations under trial produced ketosis and gastro-intestinal disturbances to a degree that caused some deterioration in the military effectiveness of the troops using them. The resources of the Canadian and U.S. laboratories were immediately enlisted in the search for the offending component. It was finally discovered to be due to over-baking of biscuits and to the treatment of skim-milk powder in the baking process (245 to 247 incl.).

Other examples of the value of the field laboratory in tests were evident in the nutritional, environmental and physical fitness surveys both in Canada and in India.

At Penobscus the emphasis was on the clinical, physiological and psychological findings. The main results of this trial underlined the importance of adequate caloric values in compact rations. It also demonstrated that calories were a far more important consideration than vitamins in rations to be used for a few days only. Subsequently, and at least in part due to this report, the British War Office changed the forty-eight-hour ration to a much improved twenty-four-hour ration which was used on D-Day and in the European campaign. The results of the Prince Albert and the Colorado trials were no less important in that they led to fundamental improvements in U.S. and Canadian rations and to the creation of an entirely new Canadian (Arctic) ration. This was afterwards used in Winter Exercises: Polar Bear, Eskimo, Lemming and Musk-Ox.

Surveys in Canada were made in 1943 to determine the effects of Army feeding and basic training on the health, physical fitness and morale of newly enlisted soldiers (241 to 244 incl.). Medical students were used as controls. The troops were completely re-examined after initial training and the factors making for improvement were assessed in a strictly scientific manner. As a result the D.G.M.S. was able to make recommendations to the Army on an authoritative basis.

Research was also done at Macdonald College on the metabolic implications of using highly hydrogenated fats in compact rations (247). The improvements indicated by these researches were at once incorporated in the manufacture of Army rations.

(b) *Protective Clothing and Equipment*: The D.G.M.S. advises on all questions pertaining to the health and efficiency of troops. Examples have already been given of the important role played by medical officers in the evaluation of rations (1, 47 to 54 incl.). Another large contribution by R.C.A.M.C. personnel was made to the Winter Test Trials of Clothing and Protective Equipment, which were run during the winter of 1943-1944 (249, 250). As in the Ration Tests these trials were another instance of co-operation between the three fighting Services. Under a sub-committee of the Chiefs of Staffs Committee trials were authorized and carried out on land at Prince Albert, Sask. (dry cold), Camp Borden, Ont. (tank crews and despatch riders), Arvida, Que. (drivers of scout cars, etc.), St. John, Newfoundland (wet cold), and at sea

out of Halifax. The U.S. and British Governments fully participated with both personnel and material. Medical officers of the three Services were in charge of the observer groups and the bulk of the personnel of each of these groups was also drawn from the Medical Services.

On Excise Musk-Ox in 1946 an officer selected by D.G.M.S. accompanied the moving column as medical officer and observer while special laboratories tested men to assess nutritional and other effects of exposure.

(c) *Field Trial of Stretchers*: At A.22, Medical Training Centre, extensive and thorough trials were made during 1944-1945 of some dozen types of stretchers from various sources. Recommendations for an ideal stretcher were made (251).

PLANNING FOR THE FUTURE.

The main activities of the Medical Research Sub-Directorate and its relationship to the Associate Committee on Army Medical Research have been briefly described. It will be obvious that behind the scenes are numerous attendances at committees and conferences; frequent requests for representation at minor trials of vehicles, equipment and the like and a considerable amount of administrative work. The Sub-Directorate is recognized as the "trouble-shooting" department of D.G.M.S., and one of the good results of its activities has been the salutary increase in co-operative contact between the Medical Corps and other branches of the Army. It has also, through the National Research Council, been able to bring Army problems to the appropriate civilian institutions and scientists for solution.

High authorities have expressed themselves as being convinced that need for an active medical research and development unit in the Army has been proven during the war. The setting up of the Medical Research Sub-Directorate was an experiment. From the experience gained it is evident that a better organization can be achieved. One defect that must be remedied was the lack of provision for an interchange of officers and for personal liaison of the A.D.M.S. between Headquarters and the research unit in the field.

With the close of the war it is necessary to plan for peace. It is not thought desirable to continue the Associate Committee on Army Medical Research as it was constituted during the war. A reorganization of medical committees of the National Research Council is envisaged and it is probable that all of the committees will disappear and be replaced by a new division of medical sciences. If this comes to pass it is earnestly hoped that there will be a military section or, at least, military representation so that the fruitful association between the D.G.M.S. and the National Research Council can be continued.

The growth of modern science and the global character of war has greatly emphasized the need for close collaboration of scientists having a specialized type of training and the military organization for defence. It is now accepted that a machine or weapon is only as good as the man operating it: his clothing and equipment must allow him to fight with maximum efficiency. There are medical angles to clothing, rations, tanks, guns, snow-mobiles, gliders, and parachutes. Medical science should be made available at developmental levels.

If the Army should decide to unify all research for defence under one head the value and importance of a medical research unit will be much enhanced. Such a plan would facilitate the employment of medical scientists both civil and military in a much more integrated way than has hitherto been possible. The fission of the atom and the threat of bacterial warfare make these developments mandatory.

[NOTE.—The references to which reference is made in the text are omitted in the Journal but are included in reprints of the article.—EDITOR.]

Clinical and Other Notes.

SCRUB TYPHUS IN MALAYA.

BY

Major W. G. TEMPLETON, I.M.S., I.A.M.C.

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DURING the period October, 1945, to February, 1946, fifty-six (56) cases of scrub typhus (tsutsugamushi fever) were treated in a Military Hospital in Kuala Lumpur.

This area had long been known as a focus of infection and much of the research on all aspects of the subject has been carried out by Fletcher, Lesslar, Lewthwaite, Savor and others working in the Medical Research Institute in Kuala Lumpur itself.

During the three and a half years of Japanese occupation a studied policy of neglect was maintained and gardening, agriculture, rubber planting and tin mining were at a standstill. Secondary scrub therefore appeared not only in the country but also in the towns and gardens and the rat population became substantially increased. Conditions were therefore ideal for an epidemic of the disease and doubtless but for the early adoption of anti-typhus measures the incidence of the disease would have been much greater.

Troops were employed in garrison duty and in clearing camp sites and later Dutch forces were in training in an area some few miles from the town. There were in all 56 cases, 17 European and 39 Indian, infection being acquired with one single exception from areas in and around Kuala Lumpur. The one case acquired outside was that of a Women's Services worker who had been resident in a bungalow on the outskirts of Singapore and infection was presumably acquired there.

CLINICAL FEATURES.

Prodromal Features.—These were not marked and constitutional disturbances apart from headache and malaise were slight. Two cases had noted the eschar and local adenitis and actually reported sick on this account alone.

The onset of fever was generally sudden and was accompanied by severe headache and by vague generalized body aches. The headache was for the most part frontal or occipital and seldom temporal. Vomiting was infrequent and in no case was there any severe intestinal disturbance. Patients who had previously suffered from dengue fever were convinced that this was the same disease.

Period after onset of symptoms before admission to hospital varied between

a few hours and nine days with an average of rather less than three days. It was noticeable that those who reported late were invariably less severe infections with a lower grade of fever. A certain number of low-grade fevers with few clinical signs and indefinite symptomatology were investigated as being possible abortive cases of scrub typhus but in no case was a *Proteus* OXK agglutination titre of significance obtained. Dr. Lewthwaite (personal communication) states that in his opinion abortive cases are so rare as to be almost non-existent.

The mental state was almost uniformly one of apathy and indifference. This was such a striking feature that a provisional diagnosis could almost be made on this alone. As the disease progressed so did the lethargy increase though seldom except in the fatal cases did this deepen into coma. During the terminal phase of the fever mental condition rapidly cleared and there was little tendency towards invalidism.

An eschar was seen in 16 cases, 6 European and 10 Indian, these having the following distribution: Neck 2, shoulders 3, axillæ 4, chest 3, abdomen 2, groin 2, thigh 1.

One case (Indian) showed two typical eschars, one on shoulders and one on chest. Eschars were very characteristic, a central ulcer with surrounding zone of erythema later localizing to a circular black crust and leaving a depressed scar, in many cases still apparent after two months.

Rash was seldom well marked though it was seen in 11 European and 8 Indian—appearing between fourth and seventh days and fading within three days. Rash when present was most marked on trunk and shoulders and was of morbilliform or maculo-papular type.

Glandular enlargement in varying degree was almost uniformly present, glands being discrete, firm and tender and those draining primary eschar most prominent.

Deafness was not a feature and it was felt that the mental state of complete apathy accounted for what appeared to be failure of hearing and appreciation.

Visual disturbances were not complained of, fundi were not routinely examined but in a few cases engorgement of retinal veins was apparent.

No cases at any stage of the illness showed "tender toes"—a finding stressed by American observers in North Burma.

A study of temperature charts revealed a common pattern but with many significant variations. Duration of fever was seven to twenty-three days with an average of 15.1 days. It was noted that the height of fever was not necessarily an index of the severity of the infection and in one case who remained comatose for three days fever ranged around 100° to 102° throughout. Severe cases often showed a sharp drop in temperature on or about twelfth day, this coinciding with a drop in blood-pressure and was followed by a departure from previous sustained fever to an irregular hectic fever.

A number of cases after being afebrile for two or three days had a transitory recurrence of fever up to 101° maintained for a few hours to three days. The significance of this was not apparent but it is of some interest that three of four cases of murine typhus occurring during the same period showed this secondary fever.

RESPIRATORY SYSTEM.

Cough was a frequent complaint and in very many cases physical findings were scanty. Some 20 per cent of cases showed reddening of fauces which may well have accounted for the irritating dry cough. Rhonchi and fine basal creps were noted at some stage of the illness in the great majority of cases but only 25 per cent developed what could be termed a true bronchitis while broncho-pneumonia occurred in 7 cases. Sputum was generally mucoid becoming mucopurulent only when bronchitis was severe. Two cases showed blood tingeing of sputum with the development of bronchitis. One case following what appeared to be a localized pneumonic process in right lung developed a hæmorrhagic effusion. Aspirated fluid showed scanty polymorphs and lymphocytes in about equal numbers while fluid was sterile on culture.

CARDIOVASCULAR SYSTEM.

Pulse-rate at onset of fever was generally around 80 per minute rising at about ninth day to 100 but showing marked variation with movement and any disturbance.

Blood-pressure was recorded daily and was found to fall steadily as the disease progressed. Readings of 90/50 were by no means uncommon around the twelfth day of illness, thereafter diastolic pressure rose steadily while systolic tended to remain low often until well on in convalescence.

That there is a considerable degree of myocardial toxæmia is evident in the extremely unstable pulse-rate and the falling blood-pressure. Clinical examination of heart, however, seldom showed more than a prolongation of first sound and a lack of definition. A typical chart showing relationship of fever, pulse and blood-pressure is given as Appendix I.

Spleen was palpable in 50 per cent of cases at the height of fever though seldom more than 1 F enlarged and not markedly tender.

NERVOUS SYSTEM.

Mental state has already been commented upon.

Tremor of tongue was a very frequent feature and a certain number of cases showed fine fibrillary tremor of muscles of limbs. Reflexes tended to be sluggish—a feature noted often well on into convalescence.

Three cases during convalescence complained of paræsthesia of feet and this with reduction of reflexes suggested some degree of toxic peripheral neuritis.

GENITO-URINARY SYSTEM.

Urine examined daily showed a transient albuminuria only, while blood urea even in the most severe cases was found to be within normal limits. Estimation of urinary chlorides was found to be a very valuable guide in treatment as it proved fatally easy for chloride level to become dangerously low.

MORTALITY AND PROGNOSIS.

There were no deaths in the European cases but three Indians died. Of these two died with symptoms of intense cerebral toxæmia while the third presented the rather unusual feature of repeated hæmatemesis. At post-mortem gastric mucosa was intensely congested and covered with multiple hæmorrhagic

points, this process was confined to the gastric mucosa and apart from a few petechial pericardial hæmorrhages no other abnormal naked-eye changes were noted.

The mortality rises sharply with age but as most cases were young healthy adults age proved of little significance in this series, two cases only being over 40 years of age. During the first week of illness it was difficult to judge of the probable severity of the infection but increasing mental disturbance particularly if accompanied by restlessness was of grave significance. A rising pulse-rate and falling blood-pressure confirmed a clinical impression that all was not well and this latterly came to be the basis of assessment for initiation of penicillin therapy as discussed later.

DIAGNOSIS.

With the high incidence of eschars diagnosis was often made at time of first examination and seldom was any difficulty experienced in making an accurate clinical diagnosis within the first few days. In two cases only was the disease sufficiently atypical to depend for its diagnosis on the results of the Weil-Felix reaction.

Leucocyte counts were done on all cases and ranged between 3,600 and 11,400 with normal proportion of cells.

Weil-Felix agglutination reactions were carried out at intervals of about five days. Proteus OXK titres of diagnostic significance were reached any time between the eighth and eighteenth days, thereafter titre was generally found to fall fairly rapidly. The height of titre proved to bear little relationship to the severity of the disease and in two cases where the clinical diagnosis was not in doubt the highest Proteus OXK reading was 1/80. Accordingly it was considered that no diagnostic titre level could be fixed but in no other disease (except urban typhus) was significant OXK titre reached so that with readings of less than 1/160 the clinical diagnosis was not negatived and above that figure the diagnosis was confirmed.

DIFFERENTIAL DIAGNOSIS.

As already stated accurate clinical diagnosis was readily made and generally clinched by positive Weil-Felix reaction.

Two secondary syphilides with rash, enlarged glands and fever occurred but there was a complete absence of the typhus mental changes and a strongly positive Kahn and negative Weil-Felix reaction settled the diagnosis.

Kahn reaction was not carried out in all cases but in no case of proved typhus was Kahn quoted as more than doubtful positive—negative when repeated after the febrile phase.

Four cases of urban typhus occurred during the period under review. Clinically these were very similar to scrub typhus though no eschar was present and the disease though running an indistinguishable fever appeared to be much milder and mental changes were not observed.

The Weil-Felix reactions of these cases are of interest as showing a coincident early rise of OXK.

Day of disease	Case 1		Case 2		Case 3		Case 4	
	OXK	OX19	OXK	OX19	OXK	OX19	OXK	OX19
6—10	80	160	Nil	320	40	40	Nil	40
10—14	320	640	80	320	160	640	40	160
14—20	160	1280	320	640	160	640	40	640
20—30	Nil	640	Nil	1280	Nil	1280	Nil	640

TREATMENT.

Primary reliance must be placed on the most careful of nursing with the minimum of disturbance. In this respect we were fortunate in having a static Base hospital to which patients came without long tiresome journeys and from which there was no necessity for transference until convalescence was well established.

Adequate fluid and salt intake are considered vital essentials and carefully kept fluid balance charts and daily urinary chloride estimations were insisted upon. For the first week patient could generally be encouraged to take a diet of high caloric value but thereafter reliance had to be placed mainly on fluid nourishment and milk feeds, glucose sweetened drinks and meat extracts were given on a two-hourly basis. Diet was supplemented by compound vitamin tablets—six per day—this was thought to be of value particularly with regard to vitamin B₁ content (1 mgm. per tablet).

Mepacrine 0.1 gramme t.d.s. was given for seven days to ensure that no malaria break-through occurred.

Sedatives were liberally employed for though apathy was marked insomnia was frequent. Bromide, chloral and phenobarbitone were employed in the early stages and where there was restlessness paraldehyde was found most useful given orally, rectally or intramuscularly—this last in dosage of 10 to 15 c.c. and repeated if necessary after four hours.

The sulphonamides were not employed, previous experience having proved them to be valueless except in secondary pneumonic complications.

In no case was there clinical evidence of œdema and urinary output remained satisfactory so that recourse to diuretics was not necessary.

In cases where at about the twelfth day blood-pressure appeared to be dropping to a dangerously low level a reconstituted dried plasma infusion was given—one to two pints given by slow drip. This was in all cases found to be beneficial. One case after about 200 c.c. developed a severe rigor became deeply cyanosed and pulse was uncountably rapid. The plasma drip was stopped, foot of bed raised and coramine injection given. Recovery was rapid and patient's mental state improved quite remarkably—he himself volunteering the information that he was now going to recover—subsequent progress proved the truth of the statement.

PENICILLIN THERAPY.

In the first 20 cases treated, penicillin was not used and of these two died. It was therefore apparent that the epidemic was at least of not less than average severity and though previous reports on the use of penicillin in scrub typhus had not been encouraging further trial was considered justifiable. Accordingly

10 cases were selected as being either complicated or, as judged on clinical grounds, likely to be of more than average severity.

The special features of these 10 cases are shown in the following table:—

<i>Case No.</i>	<i>Age</i>	<i>Diagnostic data</i>	<i>Special features</i>	<i>Day of disease started penicillin</i>	<i>Penicillin dosage</i>	<i>Duration fever days</i>	<i>Results</i>
1	26	OXX 1/1280 No eschar or rash.	Onset scrub typhus coincided with road accident in which sustained fractures of femur and humerus. Developed bronchopneumonia on fifth day of illness	5	20,000 × 3 hourly to total 1,120,000 units	21	Condition remained extremely critical till fourth day of penicillin when improvement noted and subsequently maintained
2	45	OXX 1/320 Double eschar rash	A severe infection with repeated hæmatemesis	8	20,000 × 3 hourly to total 900,000	17	Died
3	50	OXX 1/640 No eschar or rash	An elderly Indian—extreme toxæmia and bilateral bronchopneumonia.	15	20,000 × 3 hourly to total 960,000	26	Day on which therapy initiated appeared almost moribund but after remaining three days semicomatose went on to complete recovery
4	24	OXX 1/2560 Eschar	Clinically a very severe infection. No respiratory complications	5	40,000 × 3 hourly to total 1,600,000	19	For first four days of therapy little changed noted—thereafter complete uncomplicated recovery
5	27	OXX 1/640 Eschar	Clinically a very severe infection with right-sided pneumonic signs	8	40,000 × 3 hourly to total 1,600,000	20	Improvement during therapy not noted—developed pleural effusion during convalescence but finally satisfactory resolution.

Case No.	Age	Diagnostic data	Special features	Day of disease started	penicillin dosage	Duration fever days	Results
6	45	OXX 1/160 Eschar and rash	A middle-aged woman of extremely poor physique—clinically bad prognosis. No pulmonary complications	9	40,000 × 3 hourly to total 1,600,000	17	Improvement not apparent during penicillin therapy but recovery complete.
7	23	OXX 1/1280 Eschar and rash	Clinically a very severe infection—extensive bronchitis	12	40,000 × 3 hourly to total 1,600,000	23	Improvement slight during therapy but anticipated deterioration did not occur—complete recovery
8	30	OXX 1/320 No eschar or rash	Patient received as transfer from another medical unit on twelfth day of illness as bilateral delayed resolution bronchopneumonia. Semicomatose on admission	15	40,000 × 3 hourly to total 1,600,000	18	Improvement noted after first day penicillin—complete recovery during prolonged convalescence
9	25	OXX 1/320 Eschar	Clinically a very severe infection—no respiratory complications	10	40,000 × 3 hourly to total 1,600,000	16	Slight improvement apparent on third day therapy
10	24	OXX 1/640 Eschar	Clinically a severe infection with bronchitis	9	40,000 × 3 hourly to total 1,600,000	18	Improvement slight during therapy but no deterioration—complete recovery

An analysis of these cases shows that:—

- (a) In all the diagnosis was confirmed.
- (b) Two cases were over 40 years of age—which *per se* renders prognosis grave.
- (c) Six cases showed pulmonary complications but what is of greater interest is that four had no evidence of such.
- (d) One case with coincident severe injuries and unmodified typhus recovered.

(e) Day of disease on which penicillin therapy was initiated varied widely depending on the particular features of the case.

(f) Penicillin dosage was increased in later cases with what was clinically judged to be a better response.

(g) The duration of fever was in no case shortened.

(h) Effects of penicillin were for the most part rather negatively satisfactory in that while improvement was not immediately apparent the anticipated deterioration of condition did not occur.

It is to be noted that in those who commenced penicillin therapy on ninth day of illness or later the improvement was apparent about the same time as would have been looked for in the uncomplicated case.

That four cases showed no evidence of pulmonary complications suggests that the alleged value of penicillin is not solely confined to counteracting or preventing onset of such secondary mischief.

The evidence that penicillin is of value is essentially therefore based on clinical impression and the view is held that while not being curative penicillin exerts a favourable influence which in severe cases may prove just sufficient to enable natural recovery to occur.

SUMMARY.

Fifty-six cases of scrub typhus treated in a Military Hospital in Malaya have been described.

Treatment has been discussed with particular reference to penicillin and a plea for further extended trial in high dosage submitted.

IMPRESSIONS OF A MEDICAL OFFICER TO A CIVIL RESETTLEMENT UNIT.

BY

Captain G. PENRHYN JONES, M.B., M.R.C.S.,

Royal Army Medical Corps.

[Received December 21, 1946.]

THE problems of the repatriated prisoner of war have attracted the attention of numerous observers, a number of articles having appeared in the medical press in the last few years. Newman, himself an escaped P.o.W., drew attention in 1944 to the prisoner mentality and the problems of repatriation. The psychological stress of captivity was observed during the 1914-18 war (Vischner, 1919). It is only during the late war that the problems of readjustment of the ex-P.o.W. to civilian life have assumed considerable importance. Cochrane (1944) states that those best adapted to imprisonment found the most difficulty in adapting to England. The state, which he happily terms "gefangenitis," is a normal reaction to an abnormal external environment; so, also the difficulties and anxieties of readjustment cannot be regarded as manifestations of profound psychological illness. It is the problem of all displaced persons generally.

Wilson (1944) stresses the need for large-scale planning adequate to meet the needs of these men in readjusting to civilian life. He states that "other things being equal, the difficulties of social adaptation on repatriation appear to be more severe in the returned P.o.W. than in any other body of men so far studied." It is essentially the problem of men having lived a life of outstanding futility with great emotional deprivations gradually adjusting themselves to normal existence. The problem is all the more difficult in that the post-war world is one vastly different from the nostalgic conception of peacetime existence carefully fostered and nurtured to offset the arid circumstances of the prison camp.

In August, 1944, the Army announced its intention to undertake the resettlement of ex-P.o.W.s who were being released or discharged to civil life and, later, a pilot Civil Resettlement Unit was opened for experimental purposes. With the cessation of hostilities in Europe great numbers of repatriates were dealt with in several C.R.U.s opened up all over the country. Each unit had on its staff at least one medical officer who was trained for this type of work.

ROLE OF CIVIL RESETTLEMENT UNIT.

The purpose of a course at a civil resettlement unit is to help the repatriate to bridge the gap between his army life and civilian life. It is a "half-way house to civvy street." The scheme is entirely voluntary, the men living as members of a free society, learning and preparing to take their place as civilians. Advice on the nature and object of C.R.U.s was given to repatriates at their initial medical board in this country soon after repatriation by specially appointed Advisory Officers.

The unit is accommodated whenever possible in large buildings with agreeable surroundings and within easy reach of town and industrial districts. Hutted camps and features reminiscent of Stalag life are avoided and the atmosphere carefully prepared to avoid any trace of the unpleasant features the repatriate had come to associate with military life.

The Staff, which includes a proportion of former repatriates and a number of selected A.T.S., help to break down the barriers of social adaptation aggravated by the tendency of old Stalag companions to stick together and reminisce over previous misfortunes. Included in this Specialist Staff are a Ministry of Labour official, who is in constant touch with local employment exchanges and industrial concerns; a female Civil Liaison Officer who is a trained psychiatric social worker and deals with domestic difficulties; a Vocational Officer trained in army personnel selection, who advises on vocational aptitudes and is in charge of psychological and intelligence tests the men obtain on admission to the unit. In charge of the workshops, which contain carpentry and metal work, is a Technical Officer. As with the Medical and Dental Officers the repatriate interviews the specialist by appointment with no question of parades.

Each weekly intake of repatriates is divided into groups or syndicates of 10 to 15 men each. The officer in charge of each syndicate sees each man daily, either individually or in the group and arranges the programme and interviews, and is the personal confidant of his men. The whole course lasts

up to three months but can be terminated at any time if the repatriate so desires. The programme includes visits to employment exchanges and factories, and if a man desires to take up an occupation which he has seen and interests him arrangements are made for a "job rehearsal" in that particular line, lasting a few days to several weeks.

ROLE OF THE MEDICAL OFFICER.

The medical department or "wing" is run on different lines from the usual Army arrangements. No sick parades are held. The purpose of the unit was explained to the Medical Staff and wholesale co-operation obtained. The "wing" containing a comfortably furnished "consulting room" is devoid of the so-called "barrack room" atmosphere, and informal discussion is facilitated.

The syndicate is seen first as a whole on the day following admission in order that the men may acquaint themselves with the medical department. The first group meeting is held a few days later and is in the nature of a group talk in which symptoms and anxieties are explained and reassurance given on the ultimate outcome. Therapeutic group sessions are initiated later in the course and consist of men with persistent symptoms of unsettlement and are in the nature of "open" groups where participants leave at different times and are replaced by newcomers. Some of the therapeutic groups are also conducted by the area psychiatrist, who visits the unit weekly. Social groups, which include auxiliaries and male staff personnel as well, are frequently held both by the medical and syndicate officers.

Individual interviews are arranged to suit the repatriates concerned and ample time allowed to each appointment. As each man has an individual problem as close a liaison as possible is kept with the other specialist officers and a weekly seminar is held to discuss the disposal and difficulties of individual repatriates. Domestic problems, for example, fall partly in the realm of the doctor and partly in the realm of the C.L.O. In the first 100 consecutive cases seen, 25 complained of severe domestic upheaval, such as impending divorce, being unwanted at home, etc. Minor domestic upsets in the beginning were almost universal.

The near relatives attend a weekly tea initiated by the C.L.O. and the opportunity which affords itself is utilized to contact wives and parents and in interviews which include the repatriate concerned explanation is afforded for the maladjustments encountered on both sides. Torrie (1945) draws attention to marital problems as being a frequent precipitating factor in neurosis of ex-P.O.W.s and the solution of the difficulties evolves as much on the wife as on the repatriate.

The medical officer, fulfilling the functions of a general practitioner not especially trained in psychiatry, has to deal with general medical problems as well as those peculiar to resettlement. In the early months after repatriation, chronic bronchitis in men who worked in coal and salt mines in Germany, frostbite in those who were forced to march from Poland before the Russian

advance, were two conditions much in evidence. The effects of chronic amœbic dysentery, beri-beri and malaria were later seen in repatriates from the Far East.

The greater majority of men desiring interviews with the doctor are, however, seeking a solution to their unsettlement. Inability to concentrate, insomnia, general restlessness, impotence, difficulty in mixing with people and a general feeling of "not belonging" were the most frequent symptoms complained of. Whiles, in an investigation of 100 repatriated soldiers, states that 32 of his series developed this "release syndrome." In 100 naval repatriates studied by Mallinson and Warren 41 experienced the same difficulties.

A sympathetic attitude to his interview followed by free discussion of these phenomena with a group of men having exactly the same problems is of great value to the individual repatriate to understand why coming back home is not as easy as he thought it would be. His misunderstandings can be explained and his grievances ventilated.

In the course of time it was realized that a number of men, who, although in dire need of help, did not for various reasons volunteer for C.R.U.s. A wide extension scheme was instituted and the repatriates were interviewed with the help of the local Red Cross workers in their own homes and entry to a C.R.U. course or hospital treatment advised when necessary.

The medical officer's role in dealing with repatriates is mainly in the function of friend and adviser. It is realized that when dealing with men resentful of authority in general, connoisseurs in sincerity, it is vitally necessary to approach them without sympathy or pity. The average repatriate be it emphasized, is not peculiar in any way. It was his experiences and deprivations that were abnormal.

CONCLUSION.

The deep and serious bitterness arising from being out of the picture, being unloved and unwanted in the sterility and enforced passivity of Stalag life, is softened by the essential group spirit of the resettlement unit. The barriers of unshared experiences are not only peculiar to P.o.W.s. In the chaotic post-war world it is of much greater extent, it is the problem of all people removed from their native habits and haunts, and a group spirit which is of so much value in helping their adjustment to normality may well be invaluable at the present time.

I wish to thank Colonel G. D. Harding for permission to forward this paper, and Lieutenant-Colonel W. H. Whiles for his advice on its presentation.

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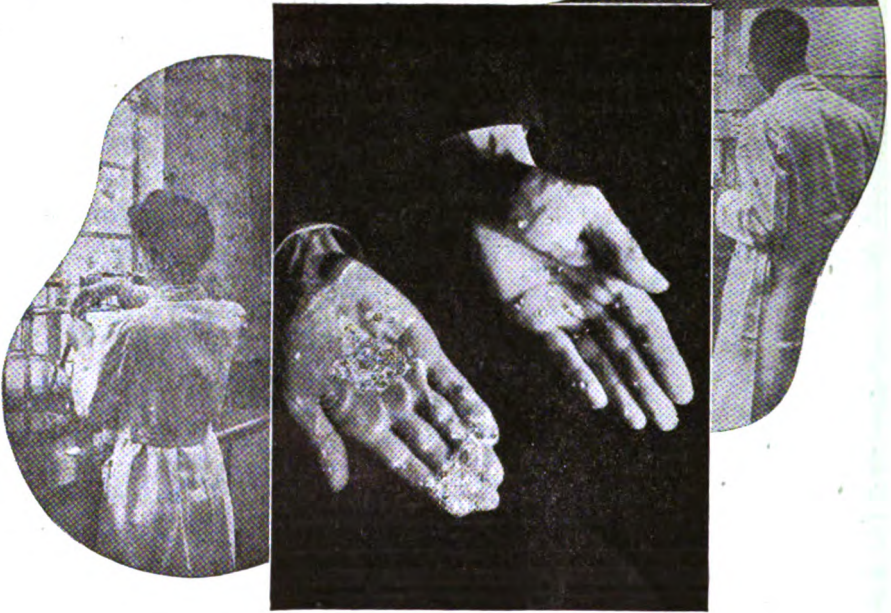
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AN OUTLINE OF THE ROLE OF THE MEDICAL SERVICES IN THE SECOND (BRITISH) ARMY'S CAMPAIGN IN NORTH-WEST EUROPE (1944-45).

Part IV.

BY

Lieutenant-Colonel R. GWYN EVANS, *M.B.E.*, M.B., M.R.C.P.

Royal Army Medical Corps (T.A.)

Late A.D.M.S., Second Army—B.L.A.

(Continued from page 140).

CHAPTER VI.

GENERAL OBSERVATIONS.

PSYCHIATRIC battle casualties are, and will remain, a problem not only for the Army Medical Services but for all branches of the Army, and a problem, moreover, which must be studied not only in time of war but also during peacetime. The campaign in N.-W. Europe, opening as it did after five years of war, made the problem of conservation of man-power in the forward area doubly serious, as the Medical Services could ill afford to evacuate psychiatric casualties which could have been prevented or presented prospects of early and complete "cure." Moreover, however well a unit or formation may have been trained for battle and thoroughly "vetted" by a psychiatrist to sift out the personnel of poor moral fibre, it is nevertheless inevitable that psychiatric casualties will occur in sufficient numbers to constitute a problem to the Medical Services. Indeed, at one stage in the Normandy Bridgehead during the heavy fighting in the Caen sector, psychiatric battle casualties rose to such an extent in some formations as to comprise more than one-fifth of the total battle casualties from all causes. Fortunately prompt measures soon reduced this incidence to some 12 to 14 per cent of the total battle casualties.

The direct causes of "nervous exhaustion" under battle conditions appear to be:—

- (i) Continuous hard fighting, without adequate periods of rest.
- (ii) The damaging effect on morale of heavy mortar fire, and especially of casualties amongst friends or respected officers and NCOs.
- (iii) Horrors and mutilating effects of H.E.

(iv) The apparent isolation felt by troops occupying forward defence positions—a factor absent in the 1914-18 war when the trench system afforded some security for contact and liaison.

(v) War weariness amongst veterans of the Western Desert.

(vi) Lack of good junior leaders owing to heavy and selective demands of the R.A.F. (and to a lesser extent of the R.N.) for potential pilots and “skippers” recruited from the more intelligent proportion of the Services intake.

(vii) The removal of the stigma and punishment for exhibiting cowardice in face of the enemy.

To prevent avoidable “breakdown” in personnel of poor moral fibre and to ensure speedy rehabilitation of minor psychiatric casualties returned to front-line duties it was essential to obtain full co-operation of unit M.O.s, and of unit officers and NCOs in the following measures:—

(i) The building up of a good “team spirit” within the unit.

(ii) Good leadership and encouragement of “waverers” by personal example.

(iii) Thorough training to give men full confidence in their weapons.

(iv) Surveillance of returning psychiatric casualties and potential “weak spirits” not only by the unit M.O. but by his company officer and platoon NCO.

(v) General “man management,” including full explanation of the unit’s role in current operations and the broad outline plan to its progress. Avoidance of boredom; ensuring full and adequate rest and especially hot food and drink even in forward positions.

The Build-up of the Army Psychiatric Service.

Before the landings in N.-W. Europe, one specialist in psychiatry had been attached to each Corps, and one to Army troops. In addition one Field Dressing Station had been allotted to each Corps for training in the handling of “battle exhaustion casualties.” All psychiatric cases were to be diagnosed “Exhaustion,” with the object of choosing a label which would not suggest to the soldier an organic disability but rather something from which he might confidently expect to recover within a short time.

Regimental Medical Officers treated cases of simple “physical exhaustion” in their own Regimental Aid Posts. More severe exhaustion cases requiring measures other than simple rest were evacuated to the Corps Exhaustion Centre formed by the Corps Field Dressing Station.

The Corps Exhaustion Centre.

The aim carried out was the sorting and treatment of those cases which were likely to recover to such an extent as to be fit for further front-line duties within one to seven days. Cases which required a longer period of treatment were evacuated further back. In the early stages of the campaign, owing to the small size of the bridgehead, the general medical policy was to evacuate all casualties—even mild—to the United Kingdom. Thus, it was only possible to hold cases for forty-eight hours and only the very mild cases with a strong likelihood of return to front-line duties were treated. Later, when the bridgehead became larger, an organization was set up for dealing with psychiatric

casualties at Army level. This meant that the original aim could be put into effect.

As far as possible, the lay-out has always been the same, viz.:—

- (i) Admission and sorting department.
- (ii) Treatment department—chiefly for sedation and resuscitation.
- (iii) Rehabilitation department, comprising accommodation for sleeping, reading, writing, dining, etc.

A diagrammatic sketch of a tented Corps Exhaustion Centre is attached at Annexure "A."

Admission and Sorting Department.

Here full particulars were taken as usual and entered up in the A & D Book. A general physical examination was made by the medical officer to exclude the chance of physical disease. A few men were found to be suffering from such infections as scabies, lice, impetigo, etc. It was important at this stage, that if a man was free from physical disease, he was given strong reassurance that this was so. Owing to the warm weather, few cases were cold and shocked, but in cold or wet weather this would have been an important factor needing prompt resuscitation treatment. Very few cases were encountered in which previous sedation by regimental or other unit medical officers had not been given. In fact, in the early days, there was a tendency to over-sedate to such an extent that patients arrived as "lying" cases. Except in those who are very restless, this should not be necessary, the aim being to produce a state of mildly doped quietness, so that the patient can arrive "sitting."

Obvious psychotics and severe psychoneurotics, for whom prolonged treatment would be necessary, were not retained, but transferred as soon as possible to the Psychiatric Centre in L of C area. Patients for whom a longer period than one week, but less than three weeks' treatment, was necessary were sent to an Army Exhaustion Centre (a Field Dressing Station organized on similar lines to this being described).

Treatment Department.

The necessity for resuscitation of shocked cases has already been stressed. The most important factor in treatment was *sleep free from anxiety*. It was far better to over-sedate than under, otherwise the patient was restless and readily disturbed by external stimuli, such as a light, noise, etc. A fairly common cause of disturbed sleep when under sedation with barbiturate drugs was bladder distension. A few cases of retention of urine occurred but it was never necessary to catheterize; an enema always did the trick! A general explanation was given to each man about the cause of his breakdown, accentuating the exhaustion factor and the fact that it was now necessary to ensure that he got deep sleep. Sedation was heavy for the first twenty-four to thirty-six hours. Thus, it was necessary to give a sedative every four to six hours on the order of the medical officer. As a rule, each patient was awakened for meals—which were light and mainly fluid—and was made to empty his

bladder before going to sleep again. Stretchers were used as beds, and lights kept fairly dim but not dark.

Drugs: (a) Soluble Barbitone (Medinal).—An initial dose of 10—20 grains and repeated every four to six hours proved excellent.

(b) Pentothal Sodium.—To very restless patients was given an initial dose of a few c.c., followed later by medinal.

(c) Phenobarbitone $1\frac{1}{2}$ grains and hyoscine $1/100$ grain intramuscularly was also tried out as an initial method of controlling very restless patients. It proved very effective. Here again, sedation was maintained by the use of medinal.

No other drugs were used.

Regimental Medical Officers and other medical unit officers have tended to use exclusively phenobarbitone (luminal), but it is not considered that this is as useful a drug as barbitone soluble (medinal). It is more cumulative and less quickly excreted. One soldier arrived at the Corps Exhaustion Centre in a very collapsed state and required energetic resuscitation. He had been given far too much luminal during the various stages of evacuation and, in addition, at one medical unit, had received morphia.

During sedation it was necessary to watch the pulse-rate, a drop below 50 being an indication of barbiturate intolerance. Nursing orderlies were instructed to turn men who were restless and talk to them in a quiet reassuring manner if they were muttering in their sleep. This was usually an indication of too little sedative, uncomfortable bed, full bladder, etc. Night orderlies were also made to render morning reports. Fluids were given as often as possible to aid elimination of sedatives.

When the effect of sedation had passed off and the exhaustion abated, each patient was given a psychiatric interview; it was then possible to decide with even more accuracy which cases needed further evacuation and those selected were evacuated forthwith. At the end of approximately forty-eight hours the remainder were transferred to the rehabilitation department.

Rehabilitation Department.

The main function of this department was an attempt to rebuild the man's confidence and restore his personal pride. It was organized by the stretcher bearer officers (non-medical) of the various Field Dressing Stations who did a remarkably good job.

The factors of importance aimed at were—feeling of security (e.g. away from gunfire if possible), homely atmosphere, with such comforts as wireless set, reading material, good and well-served food, change of clothing, provision of writing material, and good facilities for further rest and sleep when necessary. This restoration of the man's confidence and feeling of personal pride was aided in other ways, e.g. by intimate talks with him, by group discussions, which were usually presided over by the stretcher bearer officer, by lectures on the war situation by members of the Education Branch at Corps HQ. and, on one occasion, a talk by Corps Interrogation Officer, who took great delight in pointing out how very much worse was the lot of the German soldier!

As far as possible, men were arranged in groups roughly equivalent to the date of their transfer to the department. On the first day "up" they were left, more or less, to their own devices, so as to recover their legs. The remaining days they spent occupying their time with useful duties and play. They were encouraged to help in the wards and routine camp duties, supplied with mending material to repair clothes, socks, etc. A certain amount of time was given every day to organized games and P.T.

A point of extreme importance was the fact that a large percentage of men arriving at the centre had no kit. Every effort was made to supply them with some of the necessities, such as razors, soap, shaving brushes, handkerchiefs, socks, etc. This was extremely difficult but partly overcome by the grand co-operation of the Welfare Services, who supplied welfare packs, books, sports kit, etc.

On about the fourth or fifth day after admission to the centre, each man was given a second short psychiatric interview, so as to make certain he was fit to return to unit. The change in appearance, attitude and general outlook of each man had to be seen to be believed.

The Normandy Bridgehead.

During the whole of June it was not possible to retain for effective treatment any psychiatric casualties, since like all other casualties they could be held in medical units for forty-eight hours only, though in some cases this was extended to three and even four days. Exhaustion centres opened from D+8 and worked on this limited basis. It was impossible to do more than a simple triage and retain for duty those few men who needed only rest and one or two good nights' sleep under sedation. The remainder were sedated and evacuated. A few severe cases were given treatment to get them into better condition for evacuation. In these circumstances not more than 10 per cent of exhaustion cases could be returned to full front line duty.

From the beginning it was apparent that many men were being evacuated who, had it been possible to retain and treat them adequately, would have recovered sufficiently to employ on either full duty or duty at base. Moreover, rightly or wrongly, the impression grew that the incidence of psychiatric casualties was exorbitant and that evacuation across the channel constituted an easy means of escape for those of poor morale. Neither contention was really correct; the incidence was actually about half what had been expected, and from the beginning Corps psychiatrists were fully aware of their responsibilities in preventing the merely frightened individual or unwilling man making this his route of escape.

Towards the end of June and beginning of July when the advanced section of 32 General (Psychiatric) Hospital arrived at Bayeux, and when 32 Field Dressing Station was opened at Vaux-sur-Mer as Second Army Rest Centre, conditions allowed the policy of evacuation of psychiatric casualties to be revised. Corps centres were able to retain cases for longer periods, the percentage returned to full duties in the line rapidly rose to between 30 and 40 per cent of those treated, milder neurotics were rehabilitated at the Rest Centre

and given useful employment at Base and severe cases evacuated to 32 Gen. Hosp. where more prolonged treatment was possible. By the end of July the only psychiatric cases which needed evacuation (except before an extensive push when wholesale evacuation is inevitable) were psychotics, psychoneurotics and unstable defectives.

From figures available it is interesting to show the number of exhaustion cases arriving at three forward medical units during the first ten days of the invasion, shown at Annexure "B."

Seasoned Divisions produced as many as or more exhaustion casualties than green Divisions. A good contrast was the 6th Airborne Div and the 51st (Highland) Div fighting alongside each other under similar strain, the first almost wholly green, the second full of old campaigners (*see* Annexure "B").

Divisional Exhaustion Centres.

During July and August our Corps exhaustion centres were taxed to the utmost; for example the centre opened by 8 Corps dealt with over 1,500 cases over a period of seven weeks.

The month of July saw a major step forward in the treatment and return to duty of exhaustion casualties by the opening of Divisional exhaustion centres. These centres took to the work admirably and showed an immediate dividend in the shape of a 50 per cent return to duty. By the end of the month over fourteen Field Dressing Stations had functioned as Divisional, Corps or Army exhaustion centres and credit was due to them all for the remarkable way they adapted themselves to their novel and arduous task.

After those early days it became the policy for each Division, when involved in any major action, to open up its own Divisional centre.

As an example of the sterling work performed by these centres it is worth quoting figures from a Field Dressing Station in 53 (W) Div which functioned entirely for the reception of exhaustion cases during the months January to March, 1945 (inclusive).

A total of 340 patients were admitted and dealt with as follows:—

Returned to full duties	...	...	...	181 = 53 per cent
Transferred to Corps exhaustion centres				152
Other method of disposal (to CCSs and Gen Hosps)	...	...	...	6
Absconded	...	...	...	1
				<hr/> 340 <hr/>

The Army Psychiatric Centre.

Very early on in the campaign (July, 1944) it was decided that the establishment of a psychiatric centre at Army level would be profitable. The first unit used for this purpose was No 31 Field Dressing Station and during those days it acted as an extremely useful "stop-gap" taking overflow cases from Corps centres filled to capacity. Later, when the incidence of psychiatric casualties

lessened it became the policy to open up the Army centre in the vicinity of Reinforcement Holding Units and the Convalescent Depot. Roughly 25 per cent of the patients seen by the psychiatrist attached to this centre initiated from the R.H.U. and there is no doubt that a very appreciable number of unsuitable combatant soldiers were conveniently weeded out at this level.

During the period November, 1944—March, 1945, in addition to the usual clinical work of the centre, short courses in psychiatry lasting three or four days were held weekly for Regimental and other Medical Officers. When, owing to operational necessity these courses were terminated, over 40 medical men had attended so that each Corps now had a good sprinkling of doctors who had derived some instruction in the methods of forward psychiatry.

Treatment Policy.

Throughout the campaign the policy deliberately pursued was to return to duty too many rather than too few psychiatric cases. Naturally an appreciable relapse rate was to be expected, but even so approximately one-third of exhaustion cases treated returned to and remained at full duty. This represented a round figure of 4,400 men saved for further battle at a time when the man-power situation was critical.

Clinical Syndromes.

It must be remembered that these cases were seen very early in their illness, very often within a few hours of onset and that a characteristic is the amazing way in which new symptoms appear and disappear. This made clear-cut classification very difficult, but in the cases seen there seemed to exist a sufficient grouping of symptom complexes to permit separation of 10 clinical syndromes, most of which varied in accordance with the method by which the person attempted to deal with his overwhelming anxiety. If not treated, such syndromes became much more clear-cut and stabilized. The prevention of such stabilization was the target of forward psychiatric treatment.

(i) *Simple Terror States (6 per cent).*—These were usually acute and sudden in onset, developing under conditions of great strain, often affecting men of previous excellent stability and immature youths in battle for the first time.

There were two main types, indicating a positive and negative reaction to the situation. Thus, the individual shouted, screamed and ran about in an aimless manner or, on the other hand, he collapsed, appeared dazed, confused and terror stricken, was afraid to move and was resentful of interference. On the whole this type responded well to treatment.

(ii) *Anxiety States (55 per cent).*—(a) *Mild:* Signs varied, but commonest were sweating, trembling, jittery anxious expectation of being hit, bombed or shelled. They were often given to weeping and complained of sleeplessness with battle dreams. Startle reaction was marked and they reacted automatically to any sudden noise and flashes of light. They were, however, co-operative and well behaved and usually optimistic concerning recovery. In some cases there was an associated depression—usually not severe and related to a sense of guilt and inferiority over having had to quit while their comrades were still fighting.

As recovery progressed and anxiety decreased, they usually became eager to return to duty.

(b) *Severe*: These cases presented an intensely striking and unforgettable picture. They came in terror-stricken, usually mute, and with very coarse tremors of the limbs, often bursting into sudden fits of crying or laughter for no apparent reason. Startle reaction was very severe and uncontrollable—the least noise caused intense activity and increase in the terror-stricken appearance. Even when absolute quiet reigned, the patient was seized with a spasm of severe trembling. He resembled, in fact, a frightened, inarticulate child, well past any organized behaviour. When talked to, his facial expression presented a child-like appeal for help.

Fortunately these severe anxiety states were not common, but they were often difficult to distinguish from a psychosis. Such cases required a longer period of treatment than was possible at Corps level, but an extended period of treatment at Base.

(iii) *Stuporose States (3 per cent)*.—On arrival such cases were in a state of stupor, lying quietly in bed, staring at nothing in particular and oblivious to what was going on around them. There was no response to questions, but they automatically obeyed commands. If made to get up, they either collapsed immediately or took a few tottering steps and then collapsed. The striking feature was the complete absence of anxiety and as recovery proceeded they often developed hysterical conversion symptoms and speech defects in the form of a stammer. The stuporose condition usually only lasted a few hours, but it might go on for days or even weeks. Sometimes it terminated quite suddenly. The treatment of such cases was not undertaken at the Corps exhaustion centre, the prognosis for return to combatant duty being poor.

(iv) *Conversion Hysteria (8 per cent)*.—The percentage of cases of true conversion hysteria without any trace of anxiety has been small. As previously described, many of the symptoms such as mutism and stammering occur in association with anxiety states. It has frequently been noted that the conversion may have a deceptive organic basis, e.g. mild trauma of the tympanic membrane, due to concussion, resulting in complete deafness.

The commonest hysterical states met with have been stammering, mutism, deafness and blindness (complete or partial), paralysis of the limbs and painful conditions which arise after some trivial injury. Included under this heading were a few cases of true amnesic fugue states.

While it may be easy enough to remove such conversion symptoms, there frequently develops afterwards an anxiety state, and for this reason no attempt at a cure was made at Corps level. All were evacuated for more extensive and prolonged treatment.

(v) *Depressive States (9 per cent)*.—Clear-cut depression seldom occurred. Usually it was a symptom accompanying other manifestations of an anxiety and only when this anxiety subsided did the depression become obvious. The patients walked about—usually on their own—with a stooping gait and hang-dog expression; they complained of complete lack of interest, difficulty in concentration and generally felt “all was lost.” There were often well-marked

guilt feelings about having failed in their duty. In one particular infantry division, there were rather high percentages of such depressive states, due to grief for the loss of comrades with whom they had been intimately associated for almost the entire period of the war. Many officers whom I examined showed evidence of well-marked depression. They were usually over-conscientious, highly sensitive, obsessional personality types.

Except in very mild cases, treatment at Corps level was unsatisfactory. The greater percentage, therefore, were evacuated to the psychiatric hospital, where a more prolonged treatment would fit them for limited employment.

(vi) *True Concussional States*.—True concussion resulting from the effects of explosion was uncommon and did not amount to more than 2 per cent of the total exhaustion cases.

(vii) *Psychosomatic Disturbance (2 per cent)*.—Only a few cases (less than 2 per cent) were placed in this category; some presented features of "effort syndromic," and all were mildly chronic neurotics with vague symptoms referred to the alimentary tract and often showing enuresis.

(viii) *Simple Physical Exhaustion (4 per cent)*.—Most of these cases had associated anxiety features detectable only because physical exhaustion had impaired their normal control over "physiological anxiety."

(ix) *Psychosis (1 per cent)*.—True psychotic breakdown was fortunately rare, but in these cases differential diagnosis was often difficult—the main clinical feature being a complete lack of anxiety or fear.

(x) *Miscellaneous Group (10 per cent)*.—This group included mental defectives, malingerers, men of "poor moral fibre" and even criminal types.

CONCLUSIONS.

There can be no room for doubt that a full and efficient psychiatric service is essential in the modern Army. There should be an Assistant Director of Psychiatry (or Adviser in Psychiatry) at Army Headquarters, with Deputies, in similar role at Corps Headquarters. Moreover, some form of specialist supervision should be available at Divisional level, either in the form of a Divisional psychiatrist or a visiting psychiatrist (from a Corps "pool") whose services are available when necessary.

With regard to the type of unit used for the purpose of treating psychiatric battle casualties, it can be stated that the most versatile unit, the Field Dressing Station, has always functioned efficiently whether at Divisional, Corps or Army level. Occasionally Field Ambulances, sections of Field Ambulances and even beds at a CCS have been utilized—all with success. Divisional exhaustion centres proved their worth. Their use served many purposes, viz. a larger "return to unit" rate, men were not lost to the Division, thereby causing less incentive to "give up" during battle, and Corps centres were not so overburdened, with the result that treatment at that level became more efficient and effective.

Experience has shown that whereas the personnel of these units enjoyed their role temporarily they would not be so content if the obligation was a

permanent one. At Corps and Divisional level this is not important but if we are to maintain the Army Psychiatric Centre, then a more permanent establishment seems necessary. The main reason for this suggestion is that the type of case for treatment at Army level is usually one "passed back" from Corps psychiatrist and one cannot expect the personnel of a Field Dressing Station to be adept in dealing with and helping in the treatment of such cases. If at all possible therefore in the future, a permanent Army Psychiatric Centre with its own war establishment to include a proportion of mental nursing orderlies and nursing officers would prove far more efficient.

ANNEXURE "A."

LAY-OUT OF A TENTED CORPS EXHAUSTION CENTRE.

RECEPTION.
Tent GS Universal.



Officer—Shelter Portable No. 10.
Extension—Shelter Portable No. 10.
Annexe 160 lb. tent for preparation
of hot sweet drinks.

SEDATION WARDS.

- A. Documentation.
- B. Medical Examination.
- C. Provision of hot drinks.
- D. Wash, change into pyjamas.
- E. Initial sedation.



Marquee HP Extending,
Capacity each 30 patients.



Psychiatrist's office for
interviews.



Tent GSU — annexe.
Eating utensils, bed-
pans, urinals, wash-
ing utensils.



Marquee HP Extending,
Capacity each 30 patients.



- A. Selection cases for further sedation and sleep.
- B. Overflow from 1 and 2.
- C. Selection for Rehabilitation Ward.

REHABILITATION.

- A. Normal domestic life.
- B. Enforced rest periods.
- C. Psychiatric interview.
- D. Selection for duty.



Marquee HP
Extending.



Recreation.
Radio.
Cards.
Games.
Books.
A B C A
lectures.

Capacity 22 persons.



Tent GSU

EVACUATION POINT.

ANNEXURE "B."

EXHAUSTION CASES ARRIVING AT THREE FORWARD MEDICAL UNITS DURING
THE PERIOD 6-16 JUNE, 1944.

Day	Number of battle cases	Number of exhaustion cases	
		Total	Expressed as % of battle casualties
D	114	0	0
D + 1	134	0	0
D + 2	125	3	3
D + 3	30	1	3
D + 4	52	0	0
D + 5	178	6	3
D + 6	149	11	7
D + 7	227	23	10
D + 8	96	12	13
D + 9	112	15	14
D + 10	248	37	15

COMPARATIVE TABLE OF EXHAUSTION CASES BETWEEN SEASONED DIV (51 H. DIV) AND AN UNTRIED DIV (6 AIRBORNE DIV) FIGHTING ALONGSIDE EACH OTHER IN CAEN SECTOR.

Week ending	51 (H) Div.			6 Airborne Div.		
	Battle cas.	Exhaustion cas.	Exhaustion %	Battle cas.	Exhaustion cas.	Exhaustion %
17 June '44 ..	205	30	15	1,871	54	3
24 June '44 ..	394	35	9	229	29	13
1 July '44 ..	177	76	43	164	10	6
Total (21 days) ..	776	141	18.2	2,264	93	4.1

PSYCHIATRIC CASES.

Statistical Analysis.—During the North-West European Campaign, the total number of Wounds—Battle casualties—was 71,383. The number of "Exhaustion" casualties was 13,255.

Detail figures are shown in the following table :—

Dates	Total exhaustion casualties	Total wounds battle casualties	Exhaustion as % of battle casualties	Weekly exhaustion rate per 1,000 troops	Operation in progress
6-24 Jun 44.	928	8,818	11.1	1.67	Establishing bridgehead.
24 Jun-29 Jul 44.	6,288	19,729	23.8	3.14	Enlarging the bridgehead over Orne and Odon and preparation for the breakout.
29 Jul-16 Sep 44.	2,199	12,563	14.2	1.17	Breakout from bridgehead and pursuit into Belgium.
16 Sep-7 Oct 44.	608	4,309	12.5	0.78	Operation MARKET GARDEN (Arnhem).

<i>Dates</i>	<i>Total exhaus- tion casualties</i>	<i>Total wounds battle casualties</i>	<i>Exhaus- tion as % of battle casualties</i>	<i>Weekly exhaus- tion rate per 1,000 troops</i>	<i>Operation in progress</i>
7 Oct– 16 Dec 44.	1,499	8,749	14.3	0.56	Clearing up to R. Maas. Adv to Overloon and Venraij. Taking of Tilburg and S'Hertogenbosch.
16 Dec 44– 6 Jan 45.	146	926	12.9	0.16	Battle of the Ardennes.
6 Jan– 24 Mar 45.	427	2,886	12.8	0.22	Holding the Maas. Operation VERITABLE Undertaken by First Cdn Army 8 Feb–10 Mar 45.
24 Mar– 21 Apr 45.	895	11,379	7.3	0.54	Operation PLUNDER (Rhine crossing).
21 Apr– 12 May 45.	257	2,018	11.3	0.23	Assault over R. Elbe and capture of Bremen leading up to final defeat of German Army.

CHAPTER VII.

CASUALTY AIR EVACUATION IN SECOND ARMY.

June, 1944, to May, 1945.

(1) GENERAL CONSIDERATIONS.

Owing to the climatic conditions in North-West Europe, absolute reliance could not be placed on air lift for casualty evacuation. Nevertheless, even during the winter months, it was usually possible to evacuate cases by air on five or six days each week; on several occasions air evacuation did not take place on two successive days owing to bad weather. There were two instances of longer intervals when adverse weather prevented casualty air evacuation—one of four consecutive days and one of five consecutive days.

In addition the mounting of any large-scale airborne operation, or the extensive use of aircraft for air resupply, invariably caused some limitation in the availability of aircraft for casualty evacuation. It was therefore necessary to ensure that alternative means of evacuation would be available at all times, should air evacuation of casualties break down either because of bad weather or non-availability of aircraft. Moreover there was always a proportion of cases unsuitable for air evacuation which had of necessity to be cleared by ambulance train, in particular infectious fevers, psychotics, earlier post-operative chest and abdominal cases and prisoners of war.

It is interesting to note that during the latter part of April, 1945, during the

advance to the Elbe and on to the Baltic, there was no necessity for ambulance train evacuation; infectious fevers were held in Army General Hospitals until free from infection and fit for evacuation by air, whilst PW sick and casualties were hospitalized in captured German medical installations, and consequently the only cases that could not ultimately be evacuated by air were a few psychotics. The average daily casualty airlift from Army area during peak battle periods was 334 cases daily. Highest casualty air-evacuation figures recorded were 816 and 645.

(2) CASUALTY CARRYING AIRCRAFT.

The aircraft used for casualty evacuation were almost entirely Dakotas, although Sparrow aircraft were used in the summer and autumn of 1944.

(a) *Dakota aircraft*

(i) Normal Capacity	Lying cases ...	18	} 24
	Sitting cases ...	6	

(ii) Short flight capacity	Lying cases ...	18	} 30
	Sitting cases ...	12	

If aircraft fitted with	Lying cases ...	24	} 30
US Army stretcher-sling	Sitting cases ...	6	

(b) <i>Sparrow aircraft</i>	Lying cases ...	14	} 21
	Sitting cases ...	7	

(3) PLANNING.

During the planning phase of each operation, early contact was made with the SMO 83 Group RAF to whom the outline Army Medical Plan was explained and the proposed hospital areas discussed in their relation to suitable airfields for casualty evacuation. After agreement had been reached on this, bids were made for facilities for casualty air evacuation from the selected airfield:—

(a) by DDMS to "Q" Branch Second Army.

(b) by SMO 83 Group RAF to ACA 83 Group.

Allocation of medical units as between Army and RAF Group to cover casualty air evacuation was decided in consultation with SMO 83 Group and target dates agreed for moves of units and commencement of air evacuation. Finally SMO 83 Group was given a forecast of probable casualty air lift required during the first few days of the operation.

(4) MEDICAL ORGANIZATION FOR CASUALTY AIR EVACUATION.

(a) *Casualty Air Evacuation Cushion*.—Experience showed that a large casualty holding was required close to the airfield (not more than 3 to 5 miles distant). Holding capacity was required for 120 to 150 cases so that by filling "the cushion" overnight sufficient casualties were readily available for four to six aircraft (usually two to UK and the remaining two to four to L of C).

The following requirements are essential at any unit functioning as casualty air evacuation cushion:—

(i) Good nursing under supervision of nursing officers.

(ii) At least one and preferably two surgical teams. In practice these amply justified their presence dealing with urgent surgery arising during evacuation

or as a result of delay in evacuation (especially supervening gas gangrene). The presence of surgeons was also necessary to advise on the suitability of doubtful surgical cases for air evac, and to provide emergency surgery for units in the airfield areas.

(iii) Adequate holding capacity with reasonable facilities for meals (including light diets) and other essentials for short-term holding of post-operative cases.

(iv) Provision for resuscitation, including continuation of intravenous drip, transfusions and penicillin treatment.

(v) X-ray facilities.

On the few occasions when FDSs were utilized for casualty air evacuation cushions it was invariably necessary to attach an FSU and a number of nursing officers and even then air cushion lacked sufficient holding capacity and post-operative supervision suffered. For this reason in the last eight months of the campaign the casualty air evacuation cushion was invariably formed by a Casualty Clearing Station (usually the Army Tps CCS).

On occasions 83 Group RAF undertook to establish the Casualty Air Evacuation Cushion, utilizing one Flight of an RAF Casualty Air Evacuation Unit which fulfilled all requirements.

(b) *Casualty Air Evacuation Section*.—This was established on the airfields, and was invariably formed by the CAES of a Mobile Field Hospital RAF. The role of the CAES was to provide sheltered and covered accommodation on the airfield for 50 to 70 casualties awaiting emplaning; it had no real nursing potential and being only a transit section it could only provide refreshments and hot drinks.

The staff of the CAES were responsible for the emplaning of casualties and worked in close conjunction with flight control.

The CAES is not designed or equipped to hold cases overnight.

(c) *The Medical Air Liaison Officer*.—Attempts to obtain approval for a Medical Air Liaison Officer (MALO) to be authorized on the establishment of Medical Branch Army Headquarters met with no success, and as the presence of an RAMC officer to act as MALO at the casualty evacuation airfield was essential to the success of air evacuation it was therefore necessary to detach a Major RAMC from a Field Ambulance for full time duty as MALO.

(d) *Ambulance Cars—Allocation for Air Evacuation*.—(i) During peak battle periods one section of six amb cars were permanently engaged on the airfield conveying casualties from the CAES to aircraft.

(ii) Depending on the number of casualties for air evacuation and the distance of the Casualty Air Evacuation Cushion from the airfield a further one or two sections of ambulance cars were allotted to convey casualties from the cushion to the CAES. Usually, one section of six amb cars was permanently allotted for shuttling cases from the cushion to the CAES, and a second section assisted in the shuttling of cases to fill the cushion at night, and again (if necessary) during the late morning for the afternoon air lift.

(5) SELECTION OF CASUALTIES FOR AIR EVACUATION.

(a) Priority air evac cases as a general rule selected from the following:—

- (i) Serious eye cases.
- (ii) ~~Maxillo-facial~~ cases (non-dyspnoëic).
- (iii) Compound fractures.
- (iv) Neurosurgical cases.
- (v) Head injuries.

(b) As far as possible the following types of casualties were not evacuated by air:—

- (i) Psychotics and epileptics.
- (ii) Dyspnoëics including serious chest wounds.
- (iii) Post-operative abdomens (within ten days of operation).
- (iv) Severe shock.
- (v) Infectious fevers (if still in the infective stage).
- (vi) Restless or convulsive cases—e.g. head wounds with convulsions.

(c) Cases for air evacuation from Army area were classified "X," "Y" or "Z" into one of the following categories (dependent on the hospital holding policy in Army and L of C Gen Hosps):—

- (i) "X"—for L of C only and NOT to be sent to UK, i.e. short-term sick or cas—tonsillitis, respiratory infections, whitlows and superficial CSWs. (Note: US Airborne Tps should not be incl in this category.)
- (ii) "Y"—for L of C or UK according to available aircraft. Cases intermediate between "X" and "Z" (incl US Airborne Tps who would otherwise be in category "X").
- (iii) "Z"—for UK if at all possible, i.e. long-term sick and cas—compound fractures, cases with head or nerve injury, eye injuries, post-diphtheritis (free from infection), etc.

(6) DOCUMENTATION.

Air-sea evacuation labels were used for all cases sent for air evacuation; to avoid delay and last-minute documentation any case likely to be evacuated by air was in fact documented for air evacuation.

(7) EVACUATION FROM FORWARD UNITS.

Only on one occasion was air evacuation instituted direct from CCSs within a Corps area. As a general policy less delay ensued if cases for air evac were cleared to 200-bed Gen Hosps in the Army area in the normal manner—then transferred to the Casualty Air Evac Cushion.

There were, however, three outstanding illustrations of operations in which the existence of light aircraft for evacuation of casualties from Rear Corps Area to Army Medical installations would have proved invaluable in saving time and cutting out long road evacuations: (a) the advance to Belgium; (b) operation Market Garden—evacuation from Nijmegen; (c) the advance from the Rhine bridgehead.

Provision of light aircraft for the sole purpose of evacuation of casualties within Army area would be an invaluable asset to the existing facilities for evacuation and a great benefit in arranging evacuation of special cases—head injuries, maxillo facial cases, etc.

CHAPTER VIII.

ARRANGEMENTS FOR PROVIDING MEDICAL ASSISTANCE FOR COMMITMENTS
ARISING FROM THE OCCUPATION OF GERMANY.

GENERAL.

With the crossing of the River Rhine, it was obvious that numerous medical commitments would have to be faced by the Army Medical Services, quite apart from the purely tactical problems of a rapid mechanized advance through hostile country. Some provision had obviously to be made for arranging medical attention and any necessary evacuation for allied prisoners of war liberated in German prison camps; another commitment would obviously arise from the medical and technical supervision of German Military Hospitals, Auxiliary Hospitals and medical stores overrun in the advance. And finally, to add even more to the medical burden the medical staff of Military Government existed only in skeleton form—a skeleton staff without any adequate material resources equipment or personnel with which to plan for and meet their commitments; obviously help would have to be given from Army Medical Services to meet the Military Government's needs in dealing with Displaced Persons (DPs) and other problems such as concentration camps and civil epidemics. Consequently it was decided that the Medical Advisory Staff to Military Government would submit their plans to the Medical Staff at Army H.Q. so that full provision could be made to afford them the necessary help and resources without in any way depleting the medical potential considered essential for the successful conclusion of the Army's operations in Germany.

To augment Corps medical units and so assist DDsMS Corps in dealing with these additional commitments, the following measures were taken:—

- (i) A Field Dressing Station was removed from the order of battle of each Infantry Division (leaving Inf Divs with three Field Ambulances and one Field Dressing Station which was fully adequate to cover their medical needs in a long advance). These FDSs were placed under Army control, and sub-allotted to Corps on the scale of two per Corps.
- (ii) One light field ambulance (each comprising an HQ capable of forming a full-scale Dressing Station and four sections each with its own M.O., orderlies, ambulance cars and medical equipment).
- (iii) Army held a small reserve of FDSs and one extra Casualty Clearing Station, with which to replace FDSs allotted to Corps as they became "grounded" with ex PW or civil commitments.
- (iv) Three Field Hygiene Sections were made available for ex PW and DP camps.

ALLIED EX PRISONERS OF WAR.

Allied PW camps were in the first instance "uncovered" by Division troops, and the initial responsibility for providing medical aid and supervision was therefore that of the ADMS of the Division concerned. As the Division moved

forward with the advance, first Corps Medical Services, then Army medical units, took over the responsibility. British and US prisoners of war who were sick or casualties were evacuated in the normal way, being given priority of air evacuation over all except battle casualties. Other Allied nationals were, so far as possible, collected into suitable centres under care of their own MOs (with British medical assistance), these centres being formed at convenient hospitals or camp hospitals as the advance proceeded. A list of these centres is appended at Annexure "A".

In general the PW camps were in disorder; the men having "gone wild" with the prospect of release had in many cases ransacked and even burnt down some of the camp buildings. Electricity and water supplies were frequently out of order, and the sick had suffered from inattention. Hygiene personnel visited all camps as soon as they were uncovered so as to supervise the camp hygiene, inspect feeding arrangements, and to ensure that measures had been taken to dust with DDT all inmates prior to evacuation. It is pleasing to record that the British, Dominion and US camps were the best-organized and cleanest camps with fairly good morale. The Russians, too, showed creditable keenness to get organized, but their ideas of sanitation were indeed primitive. It was in the French and Italian camps that morale was at its lowest ebb—there appeared to be a complete lack of leaders, and the inmates were apathetic and made little or no attempt to "get things going."

A start was made with evacuation of sick and wounded French ex PW by aircraft from Luneburg shortly after the surrender; later ambulance trains for repatriation of Dutch and Belgian ex-prisoners were organized, and the first exchange of Russian ex PW took place on June 18.

DISPLACED PERSONS.

Measures for the control and evacuation of displaced persons was the responsibility of Military Government. DPs, escapists and slave workers from farms and factories were first directed to collecting posts whence they were evacuated (by nationalities) to DP camps established in Military Barracks, camps, or even part of a village.

Here they cooked, fed and lived on a family basis and tended to allow filth and excreta to accumulate. Hygiene detachments supervised all the larger centres and eventually restored hygiene and sanitary conditions to a proper footing. Medical aid posts were established, and sick requiring hospital treatment were evacuated to Ex Prisoner of War Hospitals appropriate to their nationality.

The problem presented by concentration camps seemed at first almost insuperable, and the conditions in these camps had indeed to be seen to be believed. Of these camps, that at Belsen (the so-called "sick persons' concentration camp") was the largest uncovered in the British zone, the inmates totalled 60,000. Other smaller concentration camps were uncovered including one at Sandbostel accommodating approximately 10,000 inmates, a large number of whom were cases of chronic phthisis.

GERMAN MILITARY MEDICAL INSTALLATIONS.

A total of 28 German Military and Auxiliary Military Hospitals had been overrun by the time of the capitulation; these were grouped together regionally and administered by "grounded" FDSs, or detachments (usually company strength) of a Field Ambulance. Each unit or company supervised a group of four to six German Military Hospitals totalling from 2,500 to 3,000 beds. The supervising British Unit was made responsible:—

- (i) For removing to Prisoner of War cages patients fit for discharge from hospital;
- (ii) For ensuring that cases were discharged when no longer in need of in-patient treatment so as to effect maximum economy in hospital beds. Cases not fit to evacuate to PW cages but only requiring out-patient treatment were accommodated in local houses (with security precautions) to attend the hospital as out-patients: many amputation cases were so disposed of to release hospital beds;
- (iii) For supplying from captured stocks, drugs and dressings and for supervising economy in their use;
- (iv) For collecting local military dumps of medical equipment from outlying barns, where medical equipment had been dumped for dispersal reasons;
- (v) For receiving convoys of German wounded from Denmark and Schleswig Holstein (by captured ambulance trains).

With the German surrender, accommodation had to be found for some 70,000 German Military sick and casualties from Denmark, and certain Baltic ports where numbers of casualties from the Eastern front were awaiting unloading from ships.

Excluding German Field Medical Units there were some 50,000 hospital beds established in the Schleswig Holstein peninsula, and of these only 4,000 were empty (disregarding 1,500 beds in Hamburg required for a British Military Hospital). In the Cuxhaven peninsula the situation was rather better, only 3,100 hospital beds being occupied out of a total of 4,900. Against the number of available hospital beds there remained to be budgeted some 10,000 casualties in transit by sea from Kurland and 8,000 casualties in ships lying off Lubeck, Kiel and Copenhagen. Instructions were therefore issued that the German Medical Services would immediately review all hospital cases and discharge to prisoner-of-war cages or to German concentration areas all cases no longer requiring in-patient treatment and able to march up to 5 kilometres. To increase the existing German hospital accommodation, resort was to be made to double bunking wherever practicable, and facilities were afforded to German medical staffs to take over additional accommodation adjoining their existing hospital sites. Also as a temporary measure, a small number of ambulance train parks were organized, each park comprising four ambulance trains providing a temporary 1,000-bed hospital; later, as beds became available in the hospitals these ambulance train parks were emptied of casualties. German medical stores were organized under British control at Flensburg, Rendsburg, Lubeck and Neustadt; strict control was necessary to ensure that issues were

kept to minimum essential requirements. Stocks of plaster of Paris, inhalation anæsthetics, and certain dressings were completely exhausted; fortunately intravenous anæsthetics were available as a substitute, and the shortage of dressings had to be met by compelling the civil population to make up the deficiency by dressings and bandages improvised from household materials (including sheets and muslin).

In Denmark, too, the medical situation presented a serious problem. There were some 60,000 German military sick and casualties in German hospitals, and as the normal number of sick and wounded held in Denmark was only 3,000 to 4,000 the medical stores based on this figure were rapidly being exhausted. An officer was selected for duty as ADMS Denmark and attached to the SHAEF mission in Copenhagen; he was allotted three Field Surgical Units to tour existing German hospitals on an area basis "screening" all cases no longer requiring in-patient hospital treatment and ordering their discharge to selected camps in Denmark where German forces were being concentrated for repatriation. Arrangements were also instituted for the gradual evacuation (partly by hospital ships, but mainly by ambulance trains) of the longer term German casualties. By mid-June evacuation of German sick and wounded from Denmark was proceeding satisfactorily at the rate of three ambulance trains and one hospital ship per week (clearing a total of 2,000 to 2,500 long-term cases weekly and 1,200 to 1,500 convalescents weekly.) There were good prospects, too, of rapidly increasing this rate of evacuation. As German Field Hospitals became cleared, they could be moved back to Germany to provide further hospital beds in the receiving zone.

The responsibility of the Army Medical Services in providing medical assistance for civil commitments had not materially lessened following the full establishment of Military Government, since this organization was quite unable to provide adequate resources to cover its medical commitments. Most of the demands for large-scale medical assistance in civil problems continued to fall on the Army Medical Services; with the run down of personnel and the increasing reduction in its resources it was becoming obvious that the Army Medical Services could not continue this policy indefinitely and an effort was made by Military Government Public Health Branch to begin taking over responsibility for concentration camps and the larger hospitals in use for Displaced Persons.

A résumé of captured German medical units and installations is given at Annexure "B."

ANNEXURE "A."

HOSPITAL ARRANGEMENTS FOR EX PRISONERS OF WAR AND DPs.

<i>Location and Type of camp</i>	<i>Details—Hospital and sick bay accommodation</i>	<i>Nationalities</i>	<i>Supervising Medical Unit</i>
1 Corps—			
Bocholt A2462 PWX Holding Camp	Hospital Badbentheim V6144 (550 beds) Sick Bay (capacity 10–30 cases)	Eastern Europeans (Russians)	Russian Med. Officers supervised by 1 Corps

<i>Location and Type of camp</i>	<i>Details — Hospital and sick bay accommodation</i>	<i>Nationalities</i>	<i>Supervising Medical Unit</i>
1 Corps (Contd.)—			
Borghorst A7692 (a)	Hospital Seminar	Eastern	Russian Med.
PWX Holding Camp	Burgsteinfurt A7395	Europeans	Officers super-
(b) Transit Camp for	(300 beds) Sick Bay	(Yugoslavs)	vised by 1 Corps
Brit and US	(capacity 10-30 cases)	Transit (Brit and US)	
Weeze E 944360	Sick Bay (capacity 10-30 cases)		
Hammenkeln A2148	DP camps	Hospitals for DPs Kevelaer (200 beds) Bedburg (200 beds)	1 Corps Medical supervision
Bislica A1444			
Bocholt A2362			
Rees Groin A0854			
Greven A9189 DP Assembly Centre			
Rheine V8009 DP Assembly Centre			
	Hospital Thuine V8444 for PWX (Non Brit and US)		
Everscheide W1712 PWX Holding Camp	Sick Bay		
Osnabruck (Artillery Barracks) Assembly Centre	Sick Bay		50 FDS
8 Corps—			
	Hospital for DPs Flensburg C2395		
	Hospital for DPs Hasum B9465		
	Hospital Schleswig C2763	Eastern Europeans	33 CCS
	Hospital Lubeck S9490	Eastern Europeans	15(S) Division Field Ambulance
30 Corps—			
	Hospital Weizendorf X5282 (120 beds expanding to 220)	Italian	Corps FDS
	Hospital (300 beds) Bomlitz X2982	Western Europeans	Corps FDS
	Hospital (150 beds TB and surgical) Bad Rehburh X0128	Mixed	" "
Fallingbostel X349755 PWX Holding Camp	Hospital in Camp	Russians (will later include Russian DPs)	26 FDS

30 Corps (Contd.)—

Location and Type of camp	Details — Hospital and sick bay accommodation	Nationalities	Supervising Medical Unit
Celle X2756 Reception and Dispersal Camp for PWX	Hospitals in Celle Schutzenhaus (188 beds) Berufsschule (151 beds) available for PWX	Allied Eastern European PWX	21 Lt Fd Amb

Nienburg X010497 PWX Camp (now a holding camp for Poles)	Hospital in Camp	Poles	49 FDS
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Heemson X026577 PWX	Russians, French and Belgians
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Nienburg W9950 Assembly Centre for DPs	Sick Bay	49 FDS
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ANNEXURE "B."

CAPTURED GERMAN MILITARY MEDICAL UNITS AND INSTALLATIONS.

(a) Hospitals—

(i) West of the Elbe ..	{ German Military Hospitals and Auxiliary Military Hospitals (300 beds or larger) ..	15
	Total beds 22,615 (approx)	
(ii) Denmark ..	{ Military Hospitals	37
	Field Hospitals	20
	Medical Companies	14
	Total beds 60,000 (approx)	
(iii) Remaining under German control in Corps zones, and including German Field Medical Units	{ Schleswig Holstein 80,000 military "beds" .. Cuxhaven 4,900 military beds .. Hamburg area 5,000 beds ..	

(b) Hospital trains and Ambulance trains	61
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(c) Hospital ships and carriers	4
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(d) German Military Medical Stores	
Command Medical Stores	4
Subsidiary "Dumps" in forward areas ..	7
Denmark—Command Medical stores ..	3
Approx total 1st June (excluding sub-issues)	16,000 tons

In conclusion, I should like to express my thanks to Lt-Gen. Sir Alexander Hood, *G.B.E.*, *K.C.B.*, *K.H.P.*, for permission to publish this account, and to Brig. H. L. Glyn Hughes, *C.B.E.*, *D.S.O.*, *M.C.*, for his invaluable help and guidance in preparing the outline. My thanks are also due to Lt-Col. G. A. Kane, *O.B.E.*, *T.D.*, and Lt-Col. R. J. Phillips, *M.B.E.*, for their helpful advice in the Hygiene and Psychiatric sections, and to Q.M.S. Whittimore for his expert clerical assistance.

A PSYCHIATRIST'S OBSERVATIONS IN THE B.L.A.

BY

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It has proved of considerable interest to me to meet overseas some of the men from an Infantry Battalion with whom I gained some experience of the Army during a month as attached trainee Psychiatrist, February, 1943. The unit was good enough to provide me with every facility for observation; the following attempt at description is condensed from a personal diary.

The Brigade was of a Division with a very good performance in the last war and each of the three Battalions had a good reputation to date in this war, the one I was stationed with especially so; their history dates from expeditions two hundred years ago with a tradition accumulated since. During the interval between the last two wars, their Territorial strength was high and of good quality, well supported in every sense by the northern industrial city from which they were drawn. It was quite a common thing for an appreciable proportion of the staff of the larger factories in that city to serve with their employers. Welfare work was well organized.

The types of personality in this city are about as diverse as elsewhere, but, on the other hand, they are well known to be a tough type that had experienced the more severe aspects of the 1930 industrial depression. Prosperity returned with preparation for this war mainly owing to local mineral resources. Civic pride was good for various reasons, partly from relatively small population.

At the time of my joining the unit, February, 1943, they had just returned after two years in Iceland where they had had a strenuous time on mountain training but plenty of leisure which seemed to have been well used; morale was considered to have been at its highest out there. Their reactions to home difficulties were described as being slight because of being far away but, when leave started, troubles arose from men returning with air-raid stories, most of them never having before experienced that stress; compassionate leave was very rare.

They had returned very fit and were on ordinary infantry training in Great Britain; this was carried out in a small market town in Herefordshire sufficiently rural for easy arrangements for the practice of field craft. Most of the men lived in scattered empty premises in fair comfort but slept out one night each week with the object of retaining their hardiness; the periodicity of this arrangement produced a sharp rise in colds and lowering in morale. They messed in a large market shed, ill-lit, damp and draughty; nevertheless there were few complaints about the food. The sports programme was very good for unit and inter-Battalion events, soccer, treasure hunts and so forth; there was great excitement over boxing contests, the peculiarities of the contestants being even more minutely known than might have been expected; enthusiasm for prize distributions was really genuine. Civilian amusements were very few and standardized so that the men tended to use them in an automatic way; they

felt less interested than when they were in Iceland where they had to depend more on their own resources. Absenteeism and crimes were very few; the prophylactic V.D. centre was efficient but not much used.

Education facilities showed a tendency to misinterpretation of A.B.C.A. sessions, they sounded like routine lectures rather than discussions, astonishing ignorance was unashamedly displayed on general knowledge matters. Similar groping was shown at the Padre's weekly hour but this was more helpful to unit morale, mainly, I think, because of the strong personality of the leader.

So far as personalities affect unit morale, it was of interest to note that they had had, for some years, an O.C. known to them in civilian life and very much liked, but he had just retired and his successor was very much younger and more energetic in interpreting the training arrangements. The second-in-command was an exceptionally strong personality, known to many of the men as their civilian employer. The Padre was a young athletic enthusiast and well liked. Their M.O. had been one of the city's local practitioners but he too had just retired and a rapid succession of much younger M.O.s had detracted from the positive influence of that office. A fresh M.O. had just arrived, however, who effected considerable improvement. The remaining officers were all from the same background except the recent arrivals who made a rapid adjustment to local atmosphere. Some senior officers had become psychiatrically minded as a result of hearing lectures at a battle school; a personal selection officer was there during my stay to carry out matrix and other tests on the officers. The subsequent inquiries on the subject showed the right type of interest but more complete psychiatric review had not been considered.

In order to get the best experience in the time available, I joined in diverse activities, e.g. assembling a Bren gun, to understand the degree of intelligence required for the task; range work with this weapon proved easier than with the rifle. The physique and mentality required in the use of the range finder was obvious to me and the strain of driving the unaccustomed vehicles, e.g. Bren carrier, was felt, of course, only over a short period. There was one week of intensive mulepack training in co-operation with Indian troops which helped the men to retain something of their earlier mountain training; the problem of carrying casualties by this means was obvious. The stretcher bearers' training seemed very good and included practice at getting patients across a swift river by rope; the necessary combination of dash and care was clear.

The unit showed me how they had to follow an intensive training programme frequently changed by higher authority. The amount of work in detailed interpretation carried out by the officers impressed me very much during a three-day Brigade scheme. They were testing a fresh type of radio set with no other means of communication and this proved a considerable tax on the patience of all.

The M.I. room held its sick parades at 0700 hours; there were only two obvious psychiatric cases during my five weeks' stay. The first was my batman who was not slow to learn the object of my visit; he was an obvious hysteric type with a headache and consultation with the area specialist con-

firmed the need for his remaining at duty. The second case was an inefficient helper in the cookhouse who proved to be almost mentally defective, but not quite bad enough for disposal.

It was my good fortune to be posted to North-West Europe on D+19; my first duties were with a Blood Transfusion Unit pending the opening of the Field Psychiatric Hospital. I learned from a wounded rifleman of this Battalion that they had been in the line for three weeks since D+4; their positions had been difficult but the unit were taking things very well.

During early July, I was seconded to a forward Exhaustion Centre and met the R.S.M. of this unit whom I remembered to have been an excellent type of disciplinarian of ten years' service. He was a small wiry man from the unit's city who had become very tired and mildly depressed following long-continued duties with little opportunity for sleep. He had been under considerable fire but had not experienced the effects of any explosion. He spent the usual forty-eight hours resting, without sedation, there and returned to duty and, so far as I can gather, he has remained well.

The following five cases were the only ones from this unit among the first thousand admissions to the Field Psychiatric Hospital after July 8, 1944, until October, 1944.

A private of 19 years, with twelve months' service, had a good school and employment record, satisfactory psychological development for his age and a family setting average for the northern industrial city background. He enjoyed his training, which included stretcher bearing. After three weeks in the Line on these duties, he had to bring in a badly wounded company officer who had been well liked and who subsequently died. Ten days after this, he was admitted here tremulous but the pulse-rate was 60. Mild depression was the main feature and consistent with the story. He became reconciled to the loss, as far as possible, and returned to duty after a few days.

Another private of 19 years with thirteen months' service was admitted three weeks later through a general hospital where he had been several days under investigation for anxiety. He had been about ten weeks in the Line with two spells each of five weeks, with three days or so to rest in between in a place only just out of mortar range and far from peaceful. He gave a history of "panickness" during bombardment well controlled by himself. There was an average school record, good previous health, personal and familial, though there was general psychological immaturity. Casual bricklaying was his best job; despite this he was learning to fit into his unit surprisingly well. He was sent back in a lower medical category.

A third private of 30 years, with eleven years' service, had been out here eleven weeks employed as a rifleman without rest but got on well enough until seeing his mate killed near him. His condition on admission was one of mild stupor and he was only able to communicate by gesticulation. He was able to give details of his loss with the degrees of emotion expected by ether administration. After four days he was up and about the ward helpfully, but jumpy at remote gunfire. The earlier history was not good but he came from the same setting as most of the unit. Further duties with the B.L.A. were impracticable and he was, therefore, sent to a neurosis centre in U.K.

A sergeant of 23 years, with five years' service, had become irritated easily following a near miss four weeks before admission. Deafness had returned since a course of firing eighteen months previously but he described this as variable. Full physical investigations had been carried out at a previous hospital and no organic lesion discovered. He made no further mention of deafness during his ten days' rest here and it so happened that the writer attended the said firing course and understood it to be nothing exceptional. The earlier history was of good scholastic attainment in the same city as the unit, he attended a technical school for mining during colliery employment which he liked. He

had always been a very conscientious type and shy, but had married happily and had one child. Out here he had been a Platoon Commander during seven weeks almost continuous duty and had done very well. His O.C. had written asking for him to be retained in the unit as instructor and after a short time this was recommended with lowering of medical category.

A private of 28 years, with ten years' service, spent mostly in India, on minor Battalion tasks, was admitted to hospital with pain in the chest and cough. This had followed a month of duties in defensive positions in a forward area. Physical investigation here proved negative but he was slightly tremulous. Psychiatric history showed orphanage upbringing and very difficult background generally. Routine brief sedation stopped his tremor, but he was fit only for duties of labouring type and recommended to the unarmed section of the Pioneer Corps.

Follow-up work is an obvious necessity in any form of interpretation of these findings and this has been done by correspondence with the unit. I received a letter from the Mortar Platoon Officer who told me he was the only officer in his original job. He described how there had been 100 per cent turnover in one of the companies and fairly heavy casualties throughout the Battalion. Also "the effect on unit morale of the Padre has been more than any other single man—he walks about under machine-gun fire as though it were an April shower." The Mortar officer went on to say that "the morale of the Battalion has never been higher and my own men amaze me." Almost at the same time as receiving this, I met two reinforcements in a nearby R.H.U. They seemed stable men and were able to give an account of the severe action of the unit out here during ten weeks. They said that only one stretcher-bearer out of the original sixteen was alive. They also quoted their local paper's report as stating that 50 per cent of the personnel were still of local origin.

The next series of half a dozen cases (details omitted for brevity) show similar clinical reactions to stress, but occurred among reinforcements owing to the heavy surgical casualty rate; they give a very average range of different types of psychiatric and social background; none had served with this unit for more than a week or two before breakdown. It was interesting that these "foreigners" mentioned that they felt the tradition and atmosphere of this unit despite there being such dilution of personnel.

During the battles of early spring, 1945, I was again seconded to a forward Exhaustion Centre; it was then possible to compare two other similarly constituted Battalions. Both were drawn from single but different sources; one came almost entirely from a somewhat notorious slum of a very large city and the other from what, in recent years, has become to be known as a "depressed area." Both units arrived relatively unseasoned and each produced psychiatric casualties to the point of concern on the part of the Army itself and the R.A.M.C. We found that adverse factors had had accumulative effect; all the soldiers had a similarly unsatisfactory and psychiatric background with poor training response and whom no amount of expert leadership would have improved to the point of real usefulness in the field. It was understood that all troops had been psychiatrically vetted before D-day but large-scale changes had been impracticable. It was quite expected, therefore, before the campaign that these units would prove unsatisfactory.

Study of the performance in battle of miscellaneous reinforcements in two other units homogeneous but of better morale brought out the difficulties that even average newcomers found in settling down, many of the casualties appearing among these; other reinforcements were handicapped by having been lightly wounded in Normandy and having spent three to four months in hospital in Great Britain.

On visiting "my" unit during the early spring of 1945, I learned that they gave reinforcements a month to settle down as a rule before considering them unadaptable. This Battalion was at the time stationed in a relatively quiet isolated sector of the battle zone. There were artificial floods and the general conditions were considered even by them "somewhat trying" but morale was still high. It was explained to me by the fresh C.O. quite spontaneously that overcoming difficulties of location, travel, etc., was "simply a matter of psychology."

On my return to Great Britain, in August, 1945, I was able to meet one of the former C.O.s of this unit in his own city. He is the head of a very old-established steel firm and obviously took a great interest in his earlier military duties, some of his employees having been in this unit. Naturally, the men did not all come from as good a type of factory as the one I visited, but one received some confirmation of the earlier impressions of a very good background. A chance meeting with an R.A.S.C. driver showed me the power of selection in that he had been refused entry as a Territorial because of "eyesight" but he was good enough for acceptance on 3.9.39; one heard also from his mates of the very good local name and exclusiveness in the best sense of the term; the impression received was that the strong local colour is even deeper than the rest of that part of the northern country.

Observations of this type can be of no value to the statistically orientated: really scientific conclusions would need to be based on an elaborate system of controls that might never be available. Such work could only be done by several people with a lot of material; the method used here could necessarily only be done individually. Earlier reviews have demonstrated the interplay of constitutional and environmental factors in the production of neuroses; this review of a few cases and their setting has, I think, value. The main approach here has been an assessment of unit morale in relation to individual morale and subsequent nervous breakdown.

CONCLUSION.

I think that so far as unit morale is concerned in the production of individual neurosis, this unit demonstrates that stability and especially compatibility of mates is of great importance under conditions of strain in forward areas; a man does not honestly relish the idea of facing his former workmates after a breakdown that obviously lay in his power to control. Nobody can prevent the nervous effects of explosions even in a sound man, especially when they occur on top of the cumulative minor stresses inevitable in overseas service; these, however, are minimized in a good unit.

An individual cannot easily feel psychologically identified with a unit much larger than a Battalion; much smaller group identifications, of course, occur at

the same time as part of this nerve strengthening of a Battalion. Quick retraining of lightly wounded after the barest necessary hospital treatment, subsequent re-shuffling in such a way as to return men to their own Battalion would prevent disruption of good mental atmosphere. These remarks may sound an impossible counsel of perfection but they are in accordance with well-tried principles of man-management.

I have been impressed by the need for psychiatric specialists to have experience at Battalion level; as a rapid method, the training procedure described in this paper I found very useful indeed.

I am indebted to Brigadier A. Torrie of A.M.D.11 for permission to submit these notes.



Clinical and Other Notes.

THE LLOYD ROBERTS LECTURE, 1946

(A Digest)

THIS Lecture was delivered by Field Marshal The Viscount Montgomery of Alamein, G.C.B., D.S.O., to a large and distinguished gathering of the medical profession at the Royal Society of Medicine on October 28, 1946. It was entitled "Morale, with Particular Reference to the British Soldier."

The Field Marshal dealt with morale in the particular aspect of "Morale in Battle."

Morale is necessary for success in battle. It is a mental quality conditioned by the interplay of two factors, mind and conscience.

The strength of a nation lies in its people—their virility and their capacity to work. These develop the national character which produces the fighting man. The aspects of the individual social figure are influenced by Home conditions, including upbringing and environment. The soldier remains a citizen with his individuality reflecting national character.

The Army is a fighting weapon moulded by discipline and controlled by leaders. The selection of leaders and the infusion of discipline are the basic fundamentals for success.

Men's characters may be refined by war. There are others who, under stress, surrender to fear and fatigue and allow their characters to be disintegrated with a loosening of moral fibre shown by timidity and slackness. A good soldier does not surrender to fear; he maintains his standards.

Morale is a mental quality and is that which keeps men up to humanity's level and develops a man's latent heroism. High morale maintains man's dignity at all times.

High morale is not the contentment or satisfaction derived from easy living. This is merely complacency and the acceptance of luxury.

It is not merely fitness nor healthiness. We must not confuse physical happiness with morale. Happiness may be a contributory factor to the maintenance of morale over a long period.

Many tough men are often disappointing in action although they may produce isolated acts of bravery.

The essential, basic and fundamental factors in the production of high morale are: (1) Leadership; (2) Discipline; (3) Comradeship; (4) Self-respect.

Some would include a fifth—devotion to a cause—but in the lecturer's opinion this is not basic and fundamental.

Leadership.—High morale is not possible without good leaders. All men are afraid at one time or another in a greater or lesser degree. They band together and look for guidance. The leader accepts the burden of others and

thereby acquires the right of leadership. The leader has the power of decision. Fight, and survive—fear, and be slain. The leader decides. He remains imperturbable. The leader's character develops in proportion to the responsibility with which he is entrusted. His essential qualities are decision in action and calmness in a crisis.

Discipline.—The object of discipline is the conquest of fear. The mind is so fortified that it accepts abnormal sights as the normal. There are two types of fear—sudden and gradual. Discipline strengthens the mind and instils the habit of self-control. The individual loses his identity and becomes part of a larger and stronger unit; this helps him to face the unknown.

Discipline produces the unification of men into groups who obey orders as one man. Obedience of orders is essential to good discipline.

A sense of duty is also an essential—this does not extend to abstractions but extends to the friends who are around the individual.

Comradeship.—Men must come to have an affection for each other. War is a "rough and very dirty game" but is not necessarily very grim. Men must be able to get some fun out of life, even in danger. Mutual goodwill and interdependence are a great antidote to fear. All men have within them a touch of nobility. "Greater love hath no man than this, that he lay down his life for his friend." Vital to high morale is an atmosphere of warmth and strength when a man is feeling cold and weak.

Self-respect.—There must be a determination to maintain personal standards of behaviour. Efficiency is inseparable from self-respect. If a man feels he is trusted he will feel efficient and gain self-confidence. Self-respect develops inevitably if Leadership, Discipline and Comradeship are present.

Devotion to a cause cannot be considered a fundamental factor—nor is it entirely contributory. Most soldiers are not greatly moved by "Cause." Statements such as Cromwell's are dangerous ("When a man knows . . .").

No nation can fight an unpopular war. The soldier must acquiesce in the declaration of war and his passive acceptance must be converted into enthusiasm by the four basic factors given above.

Some few are deeply moved by "a cause" which is in many a sustaining factor and *may* be a most important factor.

The lecturer then dealt with contributory factors amongst which he gave:—

Success.—High morale is possible in defeat but not during a long period of defeat when confidence in leaders will wane.

Regimental Tradition.—This can be a powerful factor, it differs slightly from comradeship which is effective in a small group. Regimental tradition is a soldier's pride in the traditions of his Regiment. In a battle soldiers do not derive comfort from the traditions of the past.

Personal Habits.—Personal life, including home life, should be in order. Trouble at home can be very weakening. A soldier's job is to fight—to kill the enemy—in so doing he has to expose himself to danger.

Administration.—The daily life of the soldier must be cared for; there must be good living conditions and good food. Remember that welfare must not be an end to itself but must be an aid to morale. Welfare is essentially soft and

morale must contain an element of hardness. If there be a choice between "guns and butter" many may well choose butter and there will be no true butter in the end.

Propaganda.—It is a good thing at times to extol the fighting soldier.

We live in a scientific age and our soldiers have to remember that our raw material is *men*. Man is still the first weapon of war and the training of men is the first consideration in the training of a fighting army. Science can be directed towards making things easier for the man.

Morale of Higher Command.—Soldiers may be worked up to a state of terrific morale. They may begin to think that they can do nothing wrong and that the Higher Command can do nothing wrong. This is a real danger.

The lecturer closed with a quotation from Henry the Vth "Oh, God of Battles—steel my soldiers' Hearts."

Reviews.

PENICILLIN. Its Properties, Uses and Preparations. The Pharmaceutical Press.
Pp. 191. Price 10s. 6d. net.

This book aims at giving general practitioners and pharmacists guidance as to the best methods of preparing and using penicillin. After brief accounts of the history and commercial manufacture of this substance, successive chapters deal with its composition and chemical properties, stability, standard units and methods of assay, pharmacology, clinical use, dispensing procedures, pharmaceutical preparations and legal considerations. Appendices give the text of relevant Statutory Rules and Orders and amendments to the British Pharmacopoeia. The aim of the publishers to give practical considerations first place in the text is carried out with success. Those for whom the book is intended will find their needs of reference clearly set forth and the book can be strongly recommended for inclusion in military medical and pharmaceutical libraries.

J. B.

A MANUAL OF TOMOGRAPHY. By M. Weinbren. London: H. K. Lewis & Co. Ltd.

This manual contains the case records of a wide variety of conditions, including lesions of the skull, facial bones, spine, pelvis, limbs, larynx, chest and stomach, pyelographies and cholecystographies. The cases are profusely illustrated with excellent reproductions of both straight radiographs and tomographs which demonstrate the help given by, and in many cases the necessity for, the taking of tomographs in order to arrive at a correct diagnosis. The book concludes with a chapter on the technical factors employed by the author in tomography. This book is excellently produced, both with regard to the print and the reproduction of the films and should prove of great interest not only to the radiologist but also to the surgeon.

J. E. S.

A SHORT HANDBOOK OF PRACTICAL ANÆSTHETICS. By Hoel Parry-Price, M.R.C.S., L.R.C.P., D.A. Bristol: John Wright & Sons. 1946. Pp. 127, illustrated. Price 12s. 6d.

This small book is the outcome of twenty years' experience of anæsthetics, during which time the author has seen the growth of modern anæsthetic methods as we know them to-day.

From his large experience as an honorary anæsthetist on the staff of a large county hospital and from his work in the Royal Navy during the war, Surgeon Commander Parry-Price has produced a very readable short book dealing with the practical side of anæsthesia.

Some anæsthetists might disagree with his views on nasal intubation, and on oral premedication in children, but these views do not detract from the general

value of the book which abounds in excellent practical advice, aptly illustrated by cases from the author's large experience.

The chapter on the difference between anæsthetics in the Service and in civil life is of particular interest, and the book can be recommended to all medical officers, and especially to those who may be called upon to act as an "occasional anæsthetist" in the Service.

W. H. S.

THE COMMON COLD. By N. D. Fabricant, M.D.

This book describes in simple, balanced manner, the ætiology, clinical picture, and treatment of the common cold. Of particular interest to the prevention of this disease in the Services are the references to the potentialities of aerosol sprays, for use in ships, barrack-rooms and billets. This book should be read by all who appreciate the amount of time lost in the Services through this widespread, and as yet uncontrolled, disease.

A. M.

MEDICAL DISORDERS OF THE LOCOMOTOR SYSTEM, including the Rheumatic Diseases. By Ernest Fletcher, M.A., M.D.Cantab., M.R.C.P.Lond. Edinburgh: E. & S. Livingstone Ltd. Pp. 625.

This is a unique book in English systematic medical literature and will be of considerable interest to the Army Medical Officer. Briefly stated, in addition to an exhaustive review of the rheumatic disease, the limb neuralgias, backache and fibrositis, it provides a review of medical disease of bone, disorders of the shoulder and foot, and the simpler methods of remedial treatment. A chapter of particular interest deals at length with the applied anatomy of the locomotor system and in this are included useful tables of muscle actions and innervations and one of ossifications. Appendices deal with solutions used for injection, serial plasters, technique of joint and muscle injections, optimum position for ankylosis and, for those especially interested in rheumatism and locomotory disorders, manipulation. Special subjects are dealt with by contributors. Among these are The Teeth as a Source of Focal Infection, Fibrositis, Radiology in Arthritis, Laboratory Findings in Rheumatism.

Numerous radiographs and photographs are well reproduced and a list of bibliographical references is given with each chapter.

The work is not without imperfections, and in the preface the author frankly admits a lack of proportion in some parts of the book. Reiter's disease syndrome receives scant treatment considering the interest which it has aroused in recent years, and the statement that keratosis blennorrhagica is a syndrome consisting of gonorrhœa, polyarthritis and cutaneous keratosis and is extremely uncommon is open to criticism by those who have reported the condition not infrequently and not always in association with gonorrhœa.

Reviewing this book for a military medical journal representing a section of the medical community often beset with problems of a locomotion not fitting into any system of readily available knowledge, we welcome its advent and recommend it for inclusion in medical libraries and to the general duty and specialist medical officer.

J. B.

DISEASES OF THE NERVOUS SYSTEM. Fifth Edition. Described for practitioners and students by F. M. R. Walshe, M.D., D.Sc., F.R.C.P.London, F.R.S. Edinburgh: E. & S. Livingstone Ltd. Pp. 551.

The demand for this work can be inferred from the fact that it emerges in a fifth, revised, edition in the course of a life of less than seven years. A study of its pages readily reveals the cause of its success, the clear and concise statements and descriptions of disease which dispel many mists and in which are expounded the fundamentals of sound neurological doctrine, all within a range not too formidable for the reader of general medicine. A short account of the psychoneuroses and a simple scheme for examination of the nervous system is included.

The preface to the first edition warns us that a number of the rarer affections of the nervous system find no mention in the book, and we look in vain for reference to Wernecke's superior hæmorrhagic encephalitis. The statement that the diagnosis of cysticercosis epilepsy depends on the radiographic recognition of calcified cysts might with advantage be coupled with mention of the finding of palpable nodules and biopsy of same by which diagnosis has frequently been reached at a much earlier stage of the disease.

The general practitioner and student, however, will welcome the readiness with which this book meets his requirements of reference and systematic study respectively.

J. B.

ERRATA

Page 93 of the Journal for February 1947. "The History of a Case of Diverticulosis, with Observations on Treatment," by Bernard Myers, M.D., F.R.C.P. First line of the Appendix.

For "A patient informs me" read "Mrs. Hare informs me."

ROYAL ARMY MEDICAL CORPS

WAR MEMORIAL FUND

(REGISTERED UNDER THE WAR CHARITIES ACT, 1940)

PATRON

HER MAJESTY THE QUEEN

Colonel-in-Chief

THE memorial to the fallen of the Royal Army Medical Corps in the War of 1939-1945 consists of a Fund known as the Royal Army Medical Corps War Memorial Fund. This will be devoted, firstly to the welfare of families of all ranks of the Royal Army Medical Corps who fell in the War of 1939-1945, also of all ranks of the Corps who served in that War, and of their families who may be in need through sickness or other misfortune; and secondly, to the provision of a permanent memorial, part of which shall incorporate the names of the fallen. The amount to be expended on this permanent memorial will be reduced to the smallest sum necessary to raise a memorial in keeping with the high tradition of the Corps remembering that all ranks believe that to bring succour to the living is the best way of honouring the dead.



IN ARDUIS FIDELIS

A Hymn for The Fallen

OF THE ROYAL ARMY MEDICAL CORPS

*These in the day when faith was reeling,
The hour of Hate's triumphant reign,
Followed their Master's art of healing,
And eased both friend and foe of pain.*

*None better knew what deadly evils
Must be destroyed to save Man's soul :
These too campaigned to cast out devils,
But sought to make the body whole.*

*They faced the worst that cruel war meant,
Brought mercy to the ruthless strife,
Relieved the wounds, assuaged the torment,
And dying, gave their comrades life.*

*Unarmed they bore an equal burden,
Shared each adventure undismayed ;
Not less they earned the Victor's guerdon,
Not least were these in the crusade.*

*Thus did they serve, fell in such fashion,
Their badge Thy Cross, their work Thine own :
O God of Mercy and Compassion
Remember these before Thy Throne !*

*To bloody fields and stricken beaches,
Redeemed by selfless sacrifice,
That Voice from Calvary still reaches—
“ To-day . . . with Me in Paradise.”*

R. B. P.



Portrait by Dorothy Wilding, London

18th October, 1946

As Colonel-in-Chief of the Royal Army Medical Corps, I accept with pleasure the Patronage of the Memorial Fund, and wish it every success.

We will, I trust, be able to raise a worthy monument to those members of the Corps who laid down their lives.

We wish also to make provision for the bereaved, and to bring help to any officer or man who is in need. By doing so, we can repay the debt we owe to the Royal Army Medical Corps for its magnificent work of devotion and mercy.

Elizabeth R.



Portrait by Elliott & Fry

20th December, 1946

I am glad of this opportunity of paying a tribute to all ranks of the Royal Army Medical Corps, particularly those who lost their lives or their health in the South-East Asia campaign.

The evacuation and treatment of casualties in the face of tremendous danger and difficulty deserves the highest praise and their work in the prevention of disease was a powerful factor in the attainment of final victory.

When it is remembered that the ratio of sick to wounded was reduced from 120 to 1 to 6 to 1, I feel sure that many families now happily united will wish to pay tribute to those who died and suffered in helping to bring about this result.

Mountbatten



Portrait by Vandyk

Berlin, 28th September, 1945

To the Royal Army Medical Corps with admiration and high regard to a Corps whose contribution to Victory has been beyond all calculation.

B. L. Montgomery
FIELD-MARSHAL

(Field-Marshal Lord Montgomery has given special permission for the inclusion of his Message to the Corps in this Appeal.)

AN APPEAL

by

LIEUTENANT-GENERAL SIR ALEXANDER HOOD

Director-General Army Medical Services

ONE of the very few good things that modern war brings in its train is a rapid stride forward in medical science and discovery.

The whole world to-day holds in honour the great men who have brought us the blessings of Penicillin, the Sulpha drugs, blood transfusion, D.D.T. and all the tremendous advances in modern medicine, surgery and anaesthesia.

Perhaps, however, we are sometimes prone to forget that all these discoveries would have no practical value for us had they not been brought to the sick and wounded by the vast machinery of a trained and devoted team, the backbone of which is the Royal Army Medical Corps.

It might be thought by some that a fitting memorial for a scientific Corps would be the endowment of research, the formation of scholarships, the building of libraries and laboratories or other academic benefactions. Let us not forget, however, that most of the members of the team, and of the fallen we propose to honour, were not primarily "academic," their one aim was to be the instruments by which the blessings of modern science are brought to their sick and wounded comrades.

Who was it, then, who made up this team? We had, of course, the incalculable help of some of the finest intellects in our profession, but most of our officers came to us from their practices or fresh from junior hospital appointments.

Among our men we profited enormously by the large number of technicians ; pharmacists, physiotherapists, laboratory workers, male nurses and many others who came into our ranks, but the vast majority were drawn, quite untrained, from bench or counter, workshop or lathe, from the study or the farm. They came up with no grandiose ideas of heroism and glory ; all became inspired with our traditions of service, and over 2,000 of them paid the supreme sacrifice.

These were the men who dropped from the clouds with operating tables, lamps, instruments and all the paraphernalia of modern surgery in North Africa, in Sicily, at Arnhem and the Rhine. Among them were brilliant young surgeons who, surrounded by the enemy and wounded themselves, operated night and day under conditions of unbelievable danger and discomfort, whose work would have been impossible without the help of the non-commissioned officers and men of the Corps.

These were the men who waded ashore with our Commandos and assault troops, carrying their equipment over their heads in watertight containers, the teams who did incredible feats of surgery in Japanese prison camps with carpenter's saws, odd bits of thread, old safety razor blades and bent-up table spoons, and who nursed their comrades through dysentery, malaria and beri-beri with the skill and tenderness of a trained nurse.

We think of them, too, in the Western Desert where detachments were sometimes captured and recaptured two or three times, who, none the less, carried on their work unremittingly, tending friend and foe alike.

Having regard to all these things, we, who have survived, feel that, in the words of our charter, "To succour the living is the best way of honouring the dead."

May I therefore make a threefold appeal? First to my comrades of all ranks in the Corps, let us never forget those who died or were disabled in adding so much to our grand traditions and let us try to set aside at least a day's pay for the fund.

Secondly, may I ask my professional colleagues in civil life for their generous support? There must be few who have not had contacts with the Royal Army Medical Corps during the war; we all appreciate the value of team work among all ranks and this Fund commemorates the most eminent and the most obscure on equal terms.

Finally, I should like to appeal to other Arms and Services and to the general public. I feel sure that there are many among the thousands who passed, sick or wounded, through our medical units who will avail themselves of this opportunity of paying a very practical tribute to those who looked after them in desert, jungle, prison camp and in every theatre of war. There must, too, be very many in family circles now happily reunited who would like to make a thankoffering for a life saved by the Corps on whose behalf I most confidently make this appeal.

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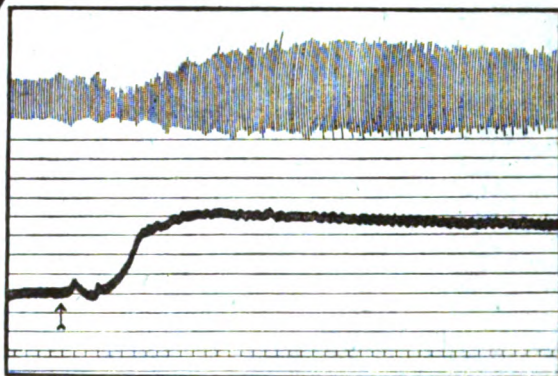
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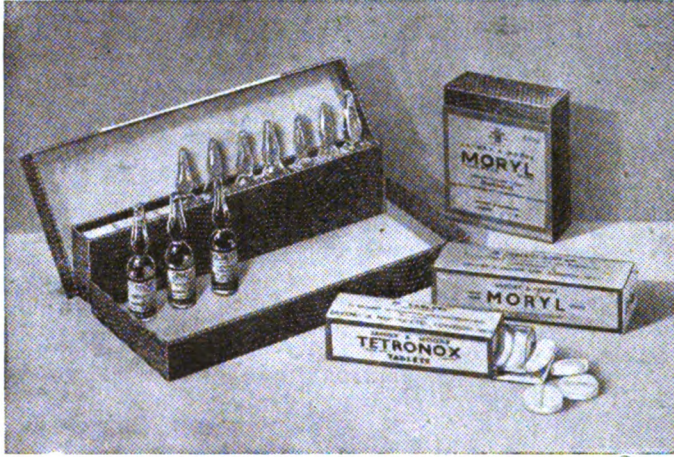
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Journal of the Royal Army Medical Corps.

Original Communications.

THE INITIAL SURGERY OF LIMB INJURIES.¹

BY

G. H. WOOLER,

Royal Army Medical Corps.

FROM ancient Egypt comes the earliest account of the treatment of wounds on the Edwin Smith Papyrus which was written in about 3000 B.C. It is a handbook on the treatment of wounds and bruises and was discovered in a tomb of Thebes in 1862. The writer recommends applying fresh flesh kept in place by a bandage for the first day and afterwards dressings of fat and honey. It also contains evidence to show that fractures were treated with splints and that surgical instruments were used at this time.

Hippocrates, living in the fifth century B.C., is the first person to have used antiseptics, for in one of his works he described how he applied tar to wounds.

Celsus, who lived from 25 B.C. to A.D. 50, described a type of wound excision. In his "De Re Medica" he stated: "Now a wound when of long standing should be cut with a scalpel, its margins excised, and incisions made at the same time into any livid areas surrounding the margins." His teaching did not last long for in the second century A.D. Galen thought that all gunshot wounds were poisoned and advocated that they should be treated by pouring in boiling oil, or by cauterization, both most painful procedures. Without question, this treatment was methodically carried out for the next 1,200 years until the time of Ambroise Paré.

Paré served thirty years in the French Army. His first taste of active service was in the attack on Turin by Francis I in 1537. There were so many casualties in Turin that Paré's supply of oil was quickly exhausted, and he was only able to treat a few of the cases as Galen had advised. To the others, he was forced to apply "a digestive of eggs, oil of roses, and turpentine." The following day he was surprised to find that those who had been dressed with the "digestive" had little pain and their wounds were not inflamed, while those who had had boiling oil applied were "feverish," with great pain and swelling of their wounds." He decided that gunshot wounds were not poisoned and

¹A thesis submitted for the M.D. of Cambridge University.

"then I resolved never more to burn thus cruelly poor men with gunshot wounds." "Je le parisait; Dieu le guarit," as it is written in Old French "I dressed him and God healed him," was Paré's favourite expression which occurs many times in his descriptions. In his account of the wounded at St. Quentin he described how he found that the ligature was often better than the cautery for controlling hæmorrhage in amputations.

About the same time a German surgeon, Wilhelm Fabry of Hilden, near Dusseldorf, acquired much experience during the Thirty Years' War. He introduced the tourniquet and proved the importance of amputating through healthy tissue in cases of gangrene.

Baron Larrey was chief surgeon to Napoleon's army. He recognized the importance of operating soon on battle casualties. He introduced his "ambulances volantes" which were light two-wheeled vehicles drawn by two horses. They could be rushed up to the front line where no heavy ambulance could be taken, so making it possible to collect and deal with the wounded quickly. At this time amputation was the rule for compound fractures and severe injuries. Larrey advised prompt amputation by the guillotine method as soon as it had been decided that the limb could not be saved. At the battle of Borodino he performed 200 amputations.

A contemporary of Larrey was Auguste Nélaton. He invented a porcelain-tipped probe to locate bullets, the porcelain being marked when it touched the leaden bullet. It is interesting that the first person whose wound was probed with this instrument was Garibaldi.

George James Guthrie was Wellington's surgeon and earned the title of "The British Larrey." In 1815 he published his monograph on "Gunshot Wounds." Like Larrey he advised that when amputation was essential it should be performed as soon as possible after injury and certainly within twenty-four hours. His rule appears to have been "When in doubt, amputate," and in his hand this carried a mortality of 50 per cent.

In 1832 Sir George Ballingall published his "Outlines of Military Surgery" which gave a clear picture of the subject before the time of Lister. The usual dressing for wounds was a cold water compress. In gunshot wounds, and especially if they involved a joint, Ballingall had "a very high opinion of the beneficial effects of large and repeated leeching" and he advised that a large supply of leeches should be available in military hospitals. Hospital gangrene, that severe anaerobic wound infection, was very common and in Ballingall's opinion was best treated by the cautery.

He wrote concerning fractures: "The practice of swinging or suspending fractured legs in a sort of cradle, as I have seen in many continental hospitals, might well be extended. It would greatly add to the comfort of the soldier compelled to travel with a broken leg." He also described a method of treating compound fractures which had recently been rediscovered and named "the closed plaster" method. He mentioned, first, how Larrey in Egypt treated compound fractures with cushions or compresses of straw which were left undisturbed until cure was complete. Then he described how "a small boy was brought to my tent in India, having sustained a compound fracture of the leg.

I was preparing to amputate the leg when the parents came and carried him away to a potter who enveloped the limb in clay and finally cured the patient."

The antiseptic method was introduced by Lister in March, 1865, in the case of a compound fracture of the leg. At first he used crude carbolic acid and various forms of putty or plaster "containing carbolic acid." To minimize the irritant action on the skin he used a "protective" such as tinfoil or oiled silk. Later he insisted that everything which touched the wound whether dressings, instruments or fingers should be treated with the antiseptic. In 1867 he published his first results in the *Lancet* under the title "On a New Method of Treating Compound Fractures." He described 11 cases, 9 recovered with life and limb, 1 died, and one had to have the limb amputated.

The introduction of antiseptics and anæsthetics together with the early treatment afforded by the "Field Hospitals" which were started in the South African war prevented the wholesale practice of amputation. Sir George Makins related his surgical experiences in South Africa and his book is "mainly a clinical study of the nature and effects of injuries produced by bullets of small calibre."

However, during the First World War new weapons were used and injuries from shellfire were more dreadful than those caused by bullets. The surgeons had little more than the records of the South African War to guide them and were bewildered by the appalling sepsis with which they were confronted in Flanders. By painfully acquired experience they learned that it was necessary to lay wounds widely open, to remove all foreign material that was readily accessible and to incise deep fascia as a decompressive measure. By 1916 such men as Henry Gray, Rutherford Morison and Carrel were performing secondary sutures. Then came the researches of Shaw Dunn and others showing that gas gangrene was a specific infection of devitalized muscle, and on this basis surgeons began deliberately to remove all dead muscle. Later the importance of the time factor was appreciated and surgical organization was directed towards getting the patient to the surgeon within eight hours.

Surgery was at its height in 1917—when the war was static and lines of evacuation were short (some patients were in London within twelve hours of wounding). By this time delayed and even primary sutures were being performed. There were no sulphonamides and no penicillin—surgeons relied on such antiseptics as hypochlorous acid (Dakin), iodoform (BIPP of Rutherford Morison), permanganate of potash and salicylic acid, while other agents such as salt bags (Gray), soap solution (Haycraft), hypertonic glucose (Beckwith Whitehouse) were all tried. Gray insisted on splintage and drainage, and all came to realize that cases must be held until the stitches had been removed. Once the war changed to one of movement, as it did in 1918, results were less good, largely because the time factor could no longer be respected.

Stammers writing in the *Lancet* in 1945 drew attention to the influence of terrain on the treatment of wounds. He stated that: "During the present war until May, 1940, casualties in France were few and were being treated according to the technique of 1917, the small numbers made any set organization for delayed suture unnecessary.

"Then came the experience of three years in the desert where evacuation lines were of unheard-of length and the time lag made delayed suture generally impossible.

"It was realized that wounds did not become so foully septic and that gas gangrene was not so common as on the soil of Flanders, and a technique of trimming and of fascial incision for decompression became the one of choice; the old 'excision' was condemned as mutilating. The influence of climate and terrain is very significant here. Compare the soldier wounded in France—wearing a dozen thicknesses of clothing soaked in rain, boots and gaitered trousers impregnated with the liquid mud of a highly cultivated country—with the soldier wounded in the desert, stripped to the waist or wearing only a thin open shirt and shorts exposed to the sun and fighting in the barren sand. It is these factors far more than the sulphanilamides that led to the good behaviour of wounds and that made a less radical operation sufficient to prevent the spreading cellulitis and pocketing of pus later to be seen in Italy."

In North Africa, a cultivated country like France, surgeons adopted an "excision" rather than a "trimming" technique.

In Sicily, surgeons from the desert and North Africa met and there were many differences of opinion regarding treatment. But in Italy wounds did behave differently from those in the desert, and it was not long before all surgeons became more radical.

Debenham had shown how conservative the surgeons in the desert had been. Writing of his experiences there he said that "Extensive operations for flesh wounds have been unnecessary and meddlesome. Wide excision has not been found necessary and a trim is adequate, usually combined with incision of the skin and deep fascia at each end of the wound to assist drainage. Long incisions are only necessary to relieve tension under the deep fascia due to a hæmatoma."

Working in an entirely different country, Stammers then related how the wounded were treated in Italy. "At the commencement of the offensive in May, 1944, and almost for the first time since 1939, conditions were ideal for delayed suture to be adopted as a routine.

- (1) Forward surgeons had learned the best way of treating wounds in Italy.
- (2) They had adequate supplies of penicillin.
- (3) There was a narrow front with short lines of evacuation along good roads.
- (4) Base hospitals were within three hours of the advanced surgical centres.
- (5) Base surgeons were fully alive to the advantages of delayed suture and organized accordingly.

"The results have been most encouraging and it is no exaggeration to say that several thousand men have been returned to duty much earlier than they would have been without delayed suture."

He stresses the following points:—

- (1) Stitches and ambulance journeys are incompatible.
- (2) All soft tissue wounds are best splinted for the journey. When muscle

is involved splinting is essential and it should include the joint below the injury.

(3) For major muscle wounds three-day course of penicillin is given. 15,000 units three-hourly intramuscularly or by glucose saline drip.

"Leave flaps of amputation stumps open—even two guiding stitches are likely to result in accumulation of clot which in turn is a source of sepsis.

"Finally after operation the wounds should not be inspected until the patient has reached the theatre of the hospital at which suture is to be performed. In the absence of pain or toxæmia any exposure of the wound at staging posts is meddlesome and will certainly lead to superimposed infection."

Except for the administration of penicillin intravenously I agree with all these observations; but I found that when penicillin was given intravenously it soon produced thrombosis of the vein.

In 1944 Donald, writing of his experience with the Eighth Army, stated that: "Immediate wound suture had no place in these campaigns, except for head and abdominal wounds. Even delayed primary and secondary suture were seldom possible, so long were the communication lines."

In fractures of the lower limb the various modifications of the Tobruk plaster all afforded satisfactory immobilization. Patients with thoracobrachial plasters for immobilizing fractures of the humerus travelled less comfortably.

Amputation was performed to conserve as much tissue as possible. "The exception to conservation is the compound fracture of the tarsus. All but the mildest of such cases require foot amputation sooner or later" and Donald believed that this was better done at once.

As early as 1942 Trueta detailed a "five-point programme" for the treatment of wounds. They were:—

(1) Prompt surgical treatment. The risk of serious post-traumatic infection is directly proportional to the time between the receipt of the wound and the surgical operation. Ether is the safest anæsthetic, spinal anæsthesia should never be used in a shocked patient. The amount of anæsthetic given should be the minimum required to enable the surgeon to carry out his task.

(2) Cleansing of the wound. He advocated soap and water followed by iodine to the skin.

(3) Excision of the wound. Without proper excision the wound should not be enclosed in plaster.

"To ensure proper excision the wound must first be enlarged. In wounds caused by high explosives the extent of damage in deeper tissues, particularly the muscles, is often enormously greater than that in the skin and superficial layers, and consequently unless the traumatic opening in the skin is considerably enlarged by incision, excision of the deeper tissues is very difficult and must generally be incomplete.

(4) Provision of drainage—where a deep and narrow cavity remains at the bottom of the wound, counter-drainage must be provided by the insertion of a piece of corrugated rubber through an opening into its most dependent part.

(5) Immobilization in plaster of Paris cast—this should be applied direct to the skin except over bony prominences.

“Good plaster of Paris is highly absorbent and facilitates the rapid absorption of discharge from the wound.”

Few of the accounts I have read on the treatment of war wounds mention the type of anæsthetic. I agree that ether is the safest to use in the hands of a not very experienced anæsthetist, but I believe that the anæsthetic is every bit as important as the surgery and in order to obtain good results the best anæsthetists must be sent forward.

I do not agree with Trueta about applying plaster of Paris directly to the skin. This may be all right if the patient is not going to be evacuated and can be watched. But this is seldom feasible during battle, and under these circumstances all plasters must be padded and split, otherwise they are going to give trouble. Twice have I seen gangrenous limbs caused by an unsplit plaster.

In 1943 Professor Yudkin recommended “adequate excision of muscle so as to produce a funnel-shaped aperture for drainage.” In late compound fractures of the femoral shaft which are infected he recommended:—

(1) Incision and approach to the site of the fracture from the lateral aspect of the thigh through the vastus lateralis muscle.

(2) Funnel-like excision of this muscle with the apex at the site of the fracture.

(3) Suturing if necessary of the skin edges to the deep fascia.

“The object of suturing skin edges to deep fascia is to prevent premature closing of the wound cavity with consequent pocketing. The skin edges are sutured to suitable deep fascia or often to muscle by means of two or three catgut sutures on each side of the wound cavity. The elastic pull of the skin then tends to retract the deep muscle layer and thus prevents occlusion of the cavity deep in the limb. This suturing should not be undertaken until the wound has been amply treated with sulphanilamide powder. It is essential to prevent any infection under the skin flaps, and this is also guarded against by the use of catgut which will absorb rapidly and enable the skin edges to retract later. This usually occurs in seven to twelve days, during which time the success of the operation is being decided. * This procedure seems to lessen the depth of the wound and the depression of the scar afterwards.”

I do not agree with this procedure at all. I can think of nothing worse than suturing all the layers of the wound together and so preventing any blood or serum between the layers getting out into the wound. I only quote this suggestion to condemn the method.

Trueta published a second paper on “War Surgery of the Extremities” in 1944. “The first essential is an examination of the patient as a whole, rather than his wounds, in order to assess his condition, and if necessary to commence resuscitation measures immediately.

“First the skin and the wounds are cleansed with soap and water. The use of a small nail brush is essential in removing dirt from the skin and tissues.”

He condemned the bold excision recommended by Russian surgeons as

harmful and unnecessary. They were treating wounds as they were cancer, excising widely through healthy tissue and in fact performing a "cancer excision."

"Instead of undertaking the excision of 'contaminated' but otherwise healthy tissue we must concentrate on removing disorganized and devitalized tissues whose blood supply has been impaired."

He did not like the thoracobrachial plaster method, of immobilizing fractures of humerus to the side of the chest, and thought that the arm should be immobilized abducted in a shoulder spica. "The arm of a man in a well-made shoulder spica should require no more space laterally than the thigh of a man in a comfortable sitting position.

"I strongly urge that all wounds and fractures of the upper half of the thigh be immobilized in a well-fitting spica and that the use of the Tobruk plaster be restricted to injuries of the knee and lower third of the femur."

He stressed the importance of elevating the limb after enclosing it in plaster to prevent œdema, and stated that this should be carried out with every limb injury even if it were just a hand.

He condemned the meddlesome surgeons on the line of evacuation who changed plasters for no apparent reason *en route*. "The first change of plaster should be carried out at base hospitals where the delayed primary sutures are being done."

Trueta recommended the application of a hip spica in certain injuries. I think it is a dangerous thing to apply, and should not be used. Patients in hip spicas travel badly, suffering considerable discomfort *en route*, and usually have enormous plaster sores when the spica is removed. This is probably due to the fact that it has not been put on properly but during evacuation a hip spica produces sores more quickly than anything else, and so it was condemned. A modification of the Tobruk plaster which I used for high compound fractures of the femur, compound hip-joints or when the buttock was involved, I shall describe at the end of the thesis. It fixed as well as a hip spica, but was not so cumbersome.

Max Page drew attention to the frequent misuse of the word *débridement* which was appearing in the surgical literature at this time.

"The word '*débridement*' used in a surgical sense appears first in French literature in the time of Ambroise Paré, and it was regularly employed by Larrey in his case records from the Napoleonic campaigns. Its significance was consistent with its derivation, viz. to release tension in the tissues by incision; the removal of any foreign body which came to hand was included in the process.

"The word continues to have this meaning in French surgical circles, though it is true that towards the end of the war 1914-18 when early wound excision was introduced as a primary measure, the word '*débridement*' was at times used to denote that procedure."

He then suggested that the word "*débridement*" should be abandoned and recommended that the terms "wound excision" or "wound revision" should be used in its place to describe the initial surgery of a wound.

Mitchiner, reviewing the results of four years of war surgery in 1944, wrote: "The main difference between wounds of this and the last war is that most of the present casualties have large lacerated wounds whereas in the last war a large number of the wounds were from bullets."

He condemned the practice of primary suture, and regarded it as a dangerous procedure.

"In through-and-through joint wounds expectant treatment is often justifiable but this should be accompanied always by immobilization of the limb and extension applied to keep the bony surfaces of the joint separate.

"In those cases in which damage to the great vessels of a limb accompanies severe compound fractures with extensive laceration of muscles it is still best to amputate promptly if the patient's life is to be saved and this applies especially if, in addition, joints have been laid open into the wounds."

He believed that "Syme's amputation has been abandoned more at the behest of the instrument maker than at the discretion of surgeons."

He recalled many Syme's amputations performed in the last war which enabled the patient not only to continue in the Army but also to walk many miles without undue fatigue.

I worked with the Canadian Corps on two occasions in Italy. They asked me to perform a Syme's amputation whenever possible and they preferred it to any other type of below-knee amputation. The reason was that they said they could make a better prosthesis for a Syme's than we could in England; whereas we could produce a better below-knee prosthesis than they could in Canada.

Limb injuries appear to be far more common than injuries to the trunk, probably because many trunk injuries are fatal and do not leave the battlefield. I have only the details of the cases I treated during the Italian campaign—a total of 1,558 cases of which 1,307 were limb injuries. Some of these were of a trivial nature so that if properly treated the men could return to their units within a few weeks.

It was very difficult to obtain a complete picture of each case and to learn the appearance of their wounds at the various ports of call in the line of evacuation. Our only connecting links with the base were the consulting surgeons and the follow-up cards which unfortunately were rarely returned. But our consultants paid us frequent visits, watched us at work, made suggestions how we should modify our technique, and told us about the cases they had seen in the base hospitals which had either done well or badly. The prognosis of each case depended upon the initial surgery, and as limb injuries are so common I propose to describe how I believe a forward surgeon should deal with them. This is my reason for choosing the subject for my thesis.

It would take a very long time to describe in detail the initial treatment of each particular limb injury which may occur in warfare. I have attempted to write about only the main principles and have described the initial treatment of wounds involving muscle, blood-vessels, bone and joints as well as a very brief plan of how to deal with important injuries such as buttock wounds and

when to perform a primary amputation. These remarks are based on experience gained from treating over 2,000 cases while I was working with a forward surgical team.

Looking back to the time when I first had to deal with war injuries I am now convinced that our treatment was not good. Patients arrived in the theatre insufficiently resuscitated, often had a bad anæsthetic, and I did not excise their wounds properly. It took us a little time to realize all the mistakes we were making, and then we began to form a plan of treatment for all injuries, and our results improved.

I think that I was inclined to rely on sulphanilamide powder rather than surgery in order to produce a clean wound. One of the best lessons I had was when my consulting surgeon told me to do approximately one hundred cases without using any bacteriostatic drug. I can remember thinking to myself at the time that I had to rely on excision alone to produce an aseptic wound, and it certainly made me more careful over my technique.

It often took me longer to excise a large wound than it did to operate on a penetrating abdominal injury. For instance, the largest wound I saw was caused by a hand grenade exploding in the trouser pocket. It had been given to the patient by his platoon serjeant—without the pin. It blew off nearly all his right gluteal muscles, the greater trochanter of his femur, extended half-way down his thigh and up into his loin. It also amputated his right forearm. This wound took me about two hours to excise, longer than I usually spent over a severe abdominal injury.

GEOGRAPHIC FACTOR.

It was also necessary to vary the amount of excision with the local conditions of the country in which the campaign was being fought. In the desert, wounds were relatively clean and required little excision, whereas in Italy and France, where we were fighting over cultivated soil, a much wider excision was necessary in order to produce a clean wound, and in particular to prevent anaerobic infection.

X-RAYS AND LOCALIZATION OF FOREIGN BODIES.

A word about X-rays. They are a help in all injuries, but are not essential, and in fact during a battle it is a great mistake to try to X-ray any other than the most deserving cases. I saw this once attempted at a Casualty Clearing Station where I was attached with my surgical team. There was a queue of wounded waiting to be X-rayed and another queue waiting for their films to be developed before they came into the theatre. Finally many of them were operated on before their films had been developed, so X-raying them had been a complete waste of time. As a rough guide all head, neck, chest, abdominal and joint injuries should be X-rayed. With limb injuries the value of radiology is to show the number and position of the foreign bodies rather than the bony injury; for at the first operation the removal of foreign material is of greater importance than the reduction of the bony deformity which does not matter so much.

When dealing with penetrating wounds of joints it is absolutely necessary to obtain antero-posterior and lateral films before attempting removal of the foreign body. In the knee-joint on two occasions I can remember going through the popliteal fossa to remove a foreign body which was lying behind one femoral condyle. The entry wound in each case was on the anterior aspect of the joint, so that without an X-ray I should not have found the foreign body.

But the importance of X-rays diminishes with the severity of the injury. I found that when dealing with very ill patients, taking films distressed them and it was difficult to obtain good films, so that they were rarely of advantage when they were produced.

PREPARATION FOR OPERATION.

After being resuscitated and if necessary X-rayed the wounded man was admitted into the operating theatre. I used to examine his field medical card and question him about his injuries, for occasionally he would tell me about one which had not been entered on his card.

Then I inspected his injury, and if it were a limb, felt for arterial pulsation distal to it. I compared the temperature with the opposite limb and tested for nerve lesions. If he had just an entry wound I would ask him where he was having pain. With this question he sometimes pointed to where the foreign body was lying. In any case I inspected the other side of the limb myself for foreign bodies frequently came to rest under the skin.

The removal of the dressing often required an anæsthetic. A gauze pad soaked in aqueous acriflavine solution was placed over the wound while the surrounding skin was shaved and cleaned. It took two orderlies to clean a limb properly. One held the limb while the other washed and shaved; and they were told to use plenty of soap and hot water for this purpose.

The pad was removed from the wound; the skin painted with flavine in spirit and towels were put round.

MULTIPLE INJURIES.

As a general rule and with very few exceptions I explored all wounds. But each case must be judged individually, and when I was dealing with multiple injuries I used to operate on the most important ones first, and took a chance with the others, doing only what was essential—such as splitting the deep fascia—rather than subjecting the patient to a long operation. I dealt with the most important wounds in the correct sequence so that the patient was moved as little as possible during the operation, because all movements worsened his general condition and lessened the time I could spend operating.

The time spent over the operation was an important factor, for the patient would stand a certain amount and no more. I had to decide what to do during this period and then stop, otherwise the length of the operation alone might have killed him.

If after excising one or two wounds his general condition deteriorated considerably and there were other wounds still requiring attention—I stopped

operating, tipped up the table so that his head was lowered, covered him with blankets, gave him blood and oxygen and left him for half an hour or so, while I dealt with another case on my second operating table. After this time, he usually recovered sufficiently for me to carry on; but now I had to work fast, for every minute counted.

THE EXCISION.

I commenced excision of a limb wound by enlarging it a little in the long axis: then by applying tissue forceps to evert the skin edges I excised the track through the subcutaneous fat liberally, for it always contained a considerable amount of dirt. I left the skin alone except to remove small tags which were obviously devitalized. I opened up the deep fascia in the long axis of the limb. It was the amount of damage deep to the deep fascia which determined how long the incisions had to be made. They must be made long enough, and should always reach to the full extent of the skin incision. I never hesitated to open up the full length of the calf or thigh if I considered it was necessary. When I was dealing with the fascia lata of the thigh, transverse incisions were required as well in order to decompress the muscle adequately. But I avoided transverse skin incisions round a limb. If the track crossed from lateral to medial aspect, I followed it from the lateral aspect as far as possible, then made a counter incision on the medial side and continued the pursuit from here. It is as well to remember that in the leg there is a deep compartment of muscles, which require decompression, when dealing with wounds in this situation. Twice have I seen necrosis of these muscles when the deep transverse fascia of the leg has not been incised.

I avoided incision over bone where the resulting scar had a chance to become adherent and painful. If there were several wounds on one side of a limb with considerable underlying muscle damage, I joined the wounds together even though the resulting incision was rather "S" shaped. It enabled me to open up the deep fascia more fully than if I had attempted to excise each wound separately.

Very small tracks involving only muscle I followed as far as possible, but would not conduct a long search for a small foreign body which in all probability would not give any trouble. I followed the track by vision rather than palpation excising damaged fascia and all muscle which would not contract or bleed.

I think the most difficult wounds to deal with were those caused by blast where large lumps of earth had been blown into the tissues. They were full of nooks and crannies containing dirt, and each one had to be opened and excised. When dealing with dirty wounds I irrigated gently with aqueous flavine solution which washed away most of the dirt—although care had to be taken not to push it more deeply into the tissues.

A good light was essential, preferably a spotlight. After removing the foreign body I carefully inspected the bed in which it was lying, for nearly always pieces of clothing were taken in as well. Sometimes the track did not

ILLUSTRATIONS.

EXCISION OF A WOUND.



FIG. 1.—Cleaning and shaving the limb.

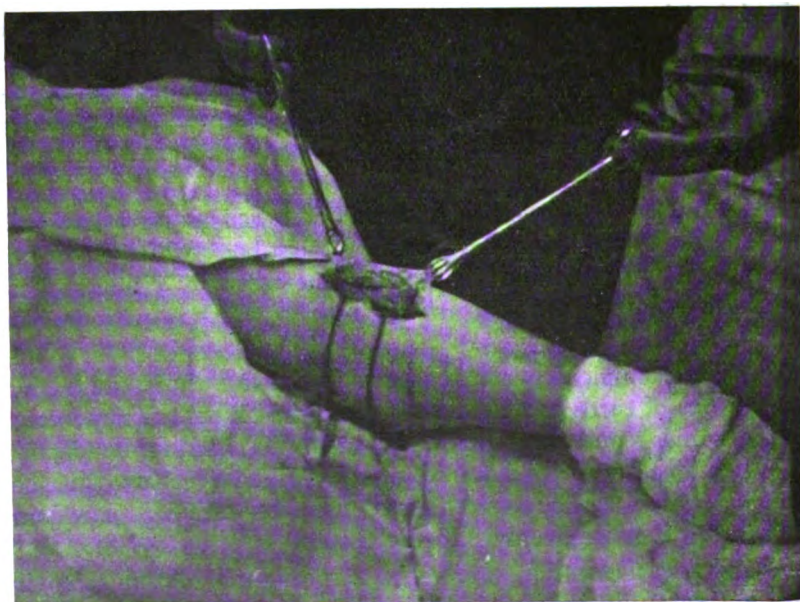


FIG. 2.—The wound has been excised down to deep fascia.

EXCISION OF A WOUND.



FIG. 3.—After excision and adequate decompression. Compare size now with fig. 1.

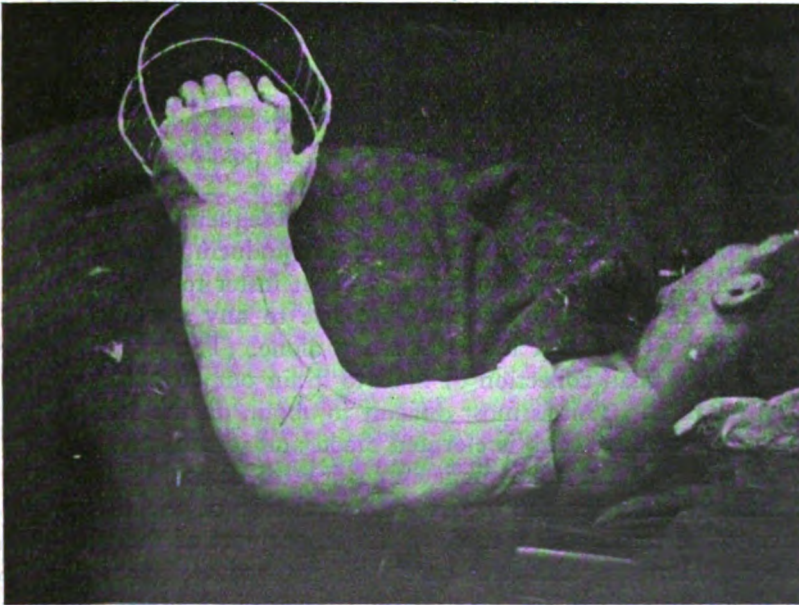


FIG. 4.—The type of plaster used for a compound fracture of radius and ulna. Cramer's wire to prevent pressure on the fingers.

end here but led to another foreign body lying more deeply. The Bosch were keen on laying mines one on top of another, so that our Sappers having removed the first might miss the ones underneath. In a similar way, very occasionally, their pieces of metal entered our men—one following another through the same entry wound. It is important to look for a second foreign body in the bed from where the first has been removed, even though there is only one entry wound.

Thus the track must be followed by vision from entry wound to foreign body, and it was rarely possible to say where it would lead. I remember one man coming into the theatre with what appeared to be small entry and exit wounds of the buttock. They eventually proved to be two entry wounds which led down through the back of the thigh from where pieces of clothing were removed. One foreign body was found in the popliteal fossa and the other in the soleus muscle. It required dissection of most of the structures on the back of the thigh in order to follow these tracks properly. The removal of foreign bodies became more important as our methods of treatment improved. When delayed primary suture was performed as a routine on the fourth to seventh day it became necessary to search for more foreign bodies and so minimize the possibility of infection later.

The size of the entry wound was often misleading and bore no relationship to the amount of underlying muscle damage or to the size of the foreign body. It was impossible to assess the amount of muscle damage from the external appearance of the wound, I think it depended upon the size, shape and velocity of the missile and whether it was rotating. The elasticity of the skin must have been responsible for the fact that I have on several occasions removed a foreign body of twice the diameter of the entry wound through which it has passed.

DRAINAGE OF WOUNDS.

My aim was to produce as aseptic a wound as possible, to allow room for the muscle to swell and to provide adequate drainage. Serum and blood oozed from the surface of the wound during the subsequent two or three days depending upon how successful I had been in producing hæmostasis. I tied off all bleeding points with thread, for I found it faster to work with than catgut and as far as I know it did not give rise to any trouble subsequently. Divided tendons or nerves I left completely alone. The well-excised wound should allow any small collection of fluid to drain out of it while the patient is lying on his back. This is most difficult to obtain on the anterior aspect of the thigh: for when the limb is elevated blood and serum collect in the upper part of the wound from where it is impossible to drain. I usually made a counter incision on either the medial or lateral side of the thigh, whichever was nearer to the track, and opened up the deeper part of the wound through this incision. How long this kept open I do not know. I considered putting a rubber drain through in certain cases, but never did this, because I was not sure when the dressing would be changed, and was anxious that the rubber drain did not stay in too long.

WOUNDS OF THE BUTTOCK.

Most buttock wounds require an X-ray examination of the abdomen, rectal examination and collection of a specimen of urine. I often opened up the track completely for through-and-through wounds of the buttock when this did not entail dividing thick muscle. I think this was a wise procedure, because the amount of muscular damage to the glutei, lying between small entry and exit wounds, surprised me; and this is impossible to excise without opening the whole track. Dirt and clothing hide themselves away between the coarse muscle fibres and cannot be seen without an adequate exposure. It also enabled me to see injuries to the superior and inferior gluteal vessels which are not uncommon, for torn arteries may be pulsating but not bleeding at the time of excision.

I never had cause to perform a colostomy for wounds near the anal margin, but evacuated such a case to a centre, where delayed primary suture could be performed as soon as possible. While excising a buttock wound I sometimes found the track going through the iliac bone. If I had previously decided that it was probably not a penetrating abdominal injury, I obtained access to the pelvis through an oblique incision about two inches medial to the anterior-superior iliac spine. This is an extraperitoneal approach and few muscle fibres need to be divided, but it enabled me to follow the track after it had entered the pelvis—giving me an excellent view of the contents, and of the internal iliac vessels if they required ligation. On two occasions I can remember following the tracks through the iliac bones and finding large foreign bodies lying by the side of the rectum, retroperitoneally. The rectal wall was a little bruised but everywhere intact. I removed the coccyx in both cases in order to drain the bed in which the foreign body had been lying. Both did well and healed within six weeks. The pelvic tissues very easily become infected and I think coccygectomy should be considered in such cases if this provides drainage for the wound track.

INJURIES TO BLOOD-VESSELS.

My opinion regarding the treatment of arterial injuries changed after I had heard Lt.-Col. Brown read his paper at the Rome Surgical Congress which he called "A Plea for Conservatism in the Primary Treatment of Wounds of the Main Arteries of the Limbs." Until this time, a suspected arterial injury I considered an indication for immediate surgery. I did not ligate the vein as well unless it was injured. But after tying the femoral, popliteal or posterior tibial artery I would split the calf fascia on the postero-medial aspect along its full length. After ligating the brachial artery I usually split the deep fascia on the volar aspect of the forearm, although I do not think it is so important as the calf.

When muscle is deprived of its blood supply it swells, and if it has no room in which to swell, it dies. It is for this reason that it is so important to open up the deep fascia widely in arterial injuries. Gauze dressing is placed on the wound and a posterior plaster slab applied for support. The limb is kept at about six inches below the rest of the body and as cool as possible. It has

lost its blood supply until the collateral vessels open up, which they usually do during the first forty-eight hours if the limb is going to live; and so in order to survive, its metabolism must be lowered—which can only be achieved by keeping it cool.

I ligated the femoral artery on five occasions in Hunter's canal. Only one of these developed gangrene and in this particular case I did not split the calf fascia because at this time I had not realized its importance. Four days after the first operation I had to perform a below-knee amputation; the skin in the flaps looked viable, but after dissecting away all the dead muscle I found that I was left with only the medial head of gastrocnemius. I thought that this was sufficient to make a stump but unfortunately the skin sloughed further and he had to have a thigh amputation at the base hospital. The case was interesting because I heard from other surgeons that in their experience the medial head of gastrocnemius is the last to become gangrenous in ischæmia of the calf. It appears to have a better blood supply than the other calf muscles. I think it was a forlorn hope trying a below-knee amputation with this case, and I should have saved the patient another operation if I had performed a thigh amputation at first.

I had three popliteal arterial injuries. One I repaired with silk and he did very well. The other two I ligated and split the calf fascia, but one of these developed gangrene necessitating a thigh amputation. The second got away with his leg, but what he was like eventually when walking about, I do not know.

Thus before the Rome Surgical Congress my practice was to operate on all suspected arterial injuries and either ligate or very rarely repair them. But I do not think that this was the soundest treatment. I now believe that a small wound involving the artery to a limb which is not bleeding externally and in which the swelling is not increasing should be left alone and watched: so that if possible the patient can be evacuated to a vascular centre where the traumatic hæmatoma can be dealt with, and this gives a better chance of preserving the limb.

COMPOUND FRACTURES.

I was taught to remove all loose pieces of bone and bone denuded of periosteum. But I am sure this is not always necessary and is, in fact, bad treatment when dealing with the long bones of the limb: for eventually any deficiency here has got to be filled up with a graft and bone chips. I think it is better when dealing with long bones to leave all loose pieces of bone in order that they have a chance to revascularize and act as grafts: aided by penicillin most of them did, and healed without becoming infected.

After excising the patella the extensor muscles to the knee-joint are lengthened relatively, so that full extension can never be performed. I only excised the patella if it was severely comminuted. When it was fractured along one of its lateral borders I excised the loose fragments and left the main part of the bone alone.

Good drainage is essential in fractures of the femoral shaft. There is always a fair amount of oozing which cannot be stopped and this must have a channel

in order to drain away, otherwise it becomes infected. An incision down to the site of the fracture along the postero-lateral aspect of the limb is often not sufficient. I used to make transverse incisions and cut away healthy muscle in order to make quite certain that this posterior drainage channel remained widely open when the limb was in plaster.

COMPOUND JOINT INJURIES.

Approximately 2 per cent of the injuries I treated involved the knee-joint. I will describe their treatment as an example of how to deal with a joint injury:—

Antero-posterior and lateral films must be taken to localize the foreign body. Minute through-and-through wounds required only aspiration of the hæmarthrosis and introduction of 50,000 units penicillin. Severer injuries, where there was considerable loss of articular cartilage and destruction of the joint, required amputation. All other wounds I excised. I used to open up the joint fairly widely in order to have a good look inside, removed the foreign body, and loose bits of cartilage or bone, then washed away blood with saline. I closed the synovial membrane, then stitched up the fibrous capsule, but left the remainder of the wound open. I injected 50,000 units of penicillin into the joint, applied dressings and a Tobruk plaster. The joint usually required a second aspiration and injection of more penicillin about the third day. In order that the joint could be inspected easily I used to cut a window in the plaster over it and fasten the loose piece of plaster in position with a bandage.

The types of knee injury which became infected were those associated with T or Y shaped fractures of the femur or tibia, i.e. where the track had passed through the femoral or tibial condyles (and taken dirt with it). It is not easy to clean a track through cancellous bone, and following up my cases at the base I found that it was this type of injury which was most likely to go wrong. I think when there is comminution of the tibial or femoral condyles you have to consider primary amputation, depending upon the amount of damage to the articular cartilage and how much dirt has been taken in.

Compound fractures of the os calcis and other tarsal bones often require primary amputation. It is impossible to excise them properly and I usually had to resort to nibbling away bits of bone and irrigation if I decided to leave the foot.

THE HAND.

Injuries of the hand require the minimum amount of surgery and only enough need be done to produce a clean wound. Protruding sharp ends of metacarpals or phalanges should be trimmed so that they are smooth and easily covered with skin. It is as well to remember that the thumb is the most important digit and as much of it as possible must be preserved. I never sutured divided tendons or put in any skin sutures. A difficult skin flap of the hand I tried to hold in position by the dressings alone.

AMPUTATIONS.

During December, 1944, 46 traumatic amputations of the lower limb were admitted to a British Casualty Clearing Station. They had been caused by the box telemine and they all had similar injuries. In each case the foot had been forcibly dorsiflexed and dislocated forwards through the ankle-joint. Often the foot was missing or might still be attached with some of the extensor tendons. The muscles were torn from the tibial and fibular shafts and pushed up near the knee-joint. Sometimes the anterior tibial vessels were torn high up in the calf as they pass through the intermuscular septum.

Fat embolism following telemine injuries was rare—I only saw one case in about a hundred such injuries. Whereas during the Gothic line battle when we were dealing chiefly with antitank mine injuries, fat embolism appeared to be fairly common. Out of twelve traumatic amputations caused by antitank mines three developed fat embolism clinically. One of these three died and the diagnosis confirmed at post-mortem, the other two survived.

Apart from traumatic amputations the two main indications for performing a primary amputation are to save the patient's life and to remove a useless limb.

When a patient is admitted to the theatre with only limb injuries—a clue to the possibility that he may require amputation is a message from the field transfusion officer stating that he has not responded well to resuscitation. With limb injuries, after hæmorrhage has been controlled, this failure of response may be due either to gross trauma pulping muscle or to gas gangrene.

If in spite of resuscitation he were going downhill I would put on a tourniquet just above the wound excluding the damaged tissues from the rest of the body. After this procedure such a case improved sufficiently to amputate proximal to the tourniquet, and after the operation when I examined the limb there was always a great deal of muscle damage or evidence of anaerobic infection.

Unless it is unavoidable I would never amputate an arm at the first operation. The main deciding factor is the amount of damage to the brachial plexus. Even if there had been extensive damage to an arm I tried to patch it up, and give it a chance, for it could always be amputated later.

The patient may stand you fixing up his arm, but if he has a leg injury as well he may not stand a second lengthy excision. The loss of a leg does not matter so much. I usually left leg injuries to the last, so that if his general condition had been exhausted while I had been dealing with an associated abdominal, chest or arm injury, I could either amputate or excise the leg wound, whichever produced the less trauma. A through-knee amputation is the quickest and least traumatic one to perform.

PRIMARY SUTURE.

Certain wounds are suitable for primary suture, but it is only advisable to attempt this during a quiet period. The patient must be held for ten to fourteen days and the stitches removed before he is evacuated. It is a great mistake to fill all available beds with sutured wounds and then be told to prepare to receive casualties. It should be a general rule not to evacuate any

casualties with the stitches still in position—they travel badly. The ideal case to perform primary suture is a recent tangential wound involving skin, subcutaneous tissue, deep fascia and muscle. After excision care must be taken over hæmostasis, then penicillin powder is applied, the skin edges trimmed and brought together with interrupted sutures. No attempt should be made to suture muscle or deep fascia. The limb is splinted with a plaster slab and parental penicillin given intramuscularly 15,000 units three-hourly for five days. After ten days the sutures are removed and dry dressing applied, movements are commenced and the patient can then be evacuated if necessary.

I did not attempt primary suture when there was a compound fracture and do not think it should be considered if there is a retained foreign body.

DRESSING AND FIXATION.

Finally about the dressing and fixation of limb injuries. After the wound had been excised I applied penicillin powder commencing in the deepest part first—muscles and tendons had to be retracted to ensure that the powder reached all over the wound. Then I put on either one layer of vaseline gauze followed by dry gauze or dry gauze alone. These must never be allowed to encircle the limb and if there are wounds on each side care must be taken to leave gaps between the gauze dressings. Wool can then be wrapped round from a roll followed by a plaster cast. Nothing under the plaster must encircle the limb other than cotton-wool. I have had to amputate at least two limbs for gangrene due to ischæmia by gauze being wrapped around the limb under a plaster cast. Every facility must be given for the limb to swell and all plaster casts should be split after being applied.

The two best weapons for fixation are plaster of Paris and the Thomas' splint. The only time I used Cramer's wire was in the form of an arch over the hand or foot to prevent the pressure of blankets.

For muscle wounds of the forearm I applied either a thin plaster cast or plaster slab which fixed the wrist in the position of strength. But when the forearm bones are fractured an above-elbow plaster should be used for immobilization.

When dealing with muscle wounds of the arm or shoulder, I bandaged the arm to the chest with two flannelette bandages followed by a few plaster bandages to keep them in position. I used this also if the scapula was fractured. But with fractures of the humerus or when the shoulder-joint was involved, I applied a thoracobrahial plaster with the arm to the side (in order to facilitate evacuation). If there was a radial nerve palsy—with the wrist in dorsiflexion—I carried the plaster to the proximal interphalangeal joints on the palmar aspect of the hand. Full movements of the interphalangeal joints must be allowed, for these are extended by the lumbricals and interossei, the extensor digitorum communis acting mainly on the metacarpophalangeal joints.

Muscle wounds of the leg, injuries to the foot and fractures of the fibula I immobilized in a below-knee plaster cast. When the tibia was fractured the plaster was carried above the knee and slung on a Thomas' splint. Muscle

wounds of the thigh I supported on a Thomas' splint, but always applied a Tobruk plaster for fractures of the femur and knee-joint injuries.

If a thigh injury was associated with a large buttock wound, I cut off the ring from a Thomas' splint and attached the lateral bars to a plaster shell for the patient to sit in. The limb rested on the remains of the Thomas' splint and both buttocks fitted into the plaster shell which was fixed around the pelvis with a many-tail binder.

I used this method several times on cases which it appeared would require a hip spica for proper immobilization. It was more easily applied and provided as good fixation. Patients travelled well in this appliance—better than they did in a hip spica.

Except for the fingers and toes which should be left as free as possible, I tried to over-immobilize an injured limb rather than to leave it with little support. Stretcher bearers will respect a leg in a Thomas' splint and treat the patient gently, whereas a thigh wound dressed with a bandage and covered with blankets may be handled roughly and then will arrive back in a swollen and œdematous condition.

For very trivial wounds requiring no immobilization I applied plaster of Paris bandages over the ordinary woven bandages in order to keep them in position. I found that dressings slipped easily during evacuation and it is important to guard against this occurring.

Lastly I always marked the time, details of the wound and operation on the plaster so that whoever received the case at the next port of call could easily find out what had been done when he inspected the limb and the plaster.

ANALYSIS OF CASES (TREATED DURING THE ITALIAN CAMPAIGN AND ON PANTELLERIA).

						<i>Total</i>	<i>Deaths</i>
Head injuries	...	...	...	...	...	18	0
Facio-maxillary	...	...	...	...	...	6	0
Chest	...	...	...	...	...	49	5
Abdomen	...	...	...	...	...	61	17
Abdomino-thoracic	...	...	...	...	...	30	13
Amputations	...	...	...	...	...	91	5
Fractures	...	...	...	...	...	305	3
Joints	...	...	...	...	...	69	0
Burns	...	...	...	...	...	87	2
Soft tissue wounds	...	...	...	...	...	842	7
						<hr/> 1,558	<hr/> 52

Amputations:

7 Above Elbow—1 death.

5 for traumatic amputation—1 died of multiple injuries elsewhere.

1 for severely comminuted radius and ulna.

1 for gas gangrene.

2 Below Elbow.

1 compound radius and ulna.

1 gangrene of forearm muscles.

29 *Above Knee*—3 deaths.

- 6 for traumatic amputation—1 died of fat embolism.
- 8 for gas gangrene—1 died.
- 7 comminuted femur involving knee-joint—1 died of multiple injuries.
- 6 comminuted femur.
- 2 severely comminuted tibia and fibula.

41 *Below Knee*—No deaths.

- 20 traumatic amputations.
- 7 comminution of tarsal bones.
- 12 comminution of tibia and fibula.
- 2 gas gangrene.

12 *Amputations of fingers and toes.*

6 cases of *Bilateral Leg Amputations*—No deaths.

- 1st, above-knee, bilateral, for gas gangrene.
- 2nd, above-knee, bilateral, for severe muscle and bone damage.
- 3rd, below-knee, bilateral, for severe mine injury.
- 4th, above-knee one side, below-knee other, for traumatic amputation and severe bone damage.
- 5th and 6th bilateral above-knee for gas gangrene.

7 *Deaths from Soft Tissue Wounds* were due to:

- 1st, external iliac vessels ligated, whole of lower limb ischæmic. Patient died four days later—could probably have been saved by a through-hip amputation, for he must have been absorbing toxins from the limb the whole time. He had no other injury and certainly appeared to die from a severe toxæmia.
- 2nd, subclavian vessels ligated—a German Prisoner of War, died soon after operation and probably was not transfused sufficiently.
- 3rd and 4th died of anuria, both had considerable muscle damage.
- 5th and 6th died of blast injury to lungs.
- 7th vomited during induction of anæsthetic and died before operation—an elderly Italian civilian.

All these cases were operated on under field conditions sometimes just within, sometimes just out of, shell range. Post-mortem examinations could not always be performed, due either to pressure of work or to the difficulties under which we were working.

Most limb injuries were evacuated immediately they came around from the anæsthetic and only the very severe ones were held. So it is difficult to give an accurate picture of every case and the ultimate result. This may account for the fact that the mortality was so low. Total number of limb injuries treated during the Italian campaign was 1,394, out of which 17 are known to have died.

I only know of one of my cases developing gas gangrene when he reached the base hospital, there may have been more but I was never told of any others.

During this war the transfusion service developed and played an enormous part. I purposely have not mentioned anything about the treatment of wound shock or "cold hypotension" as some people prefer to call it, because it is really another subject and one which is not yet fully understood. However, given adequate resuscitation worse and still worse injuries came to the theatre fit for operation. I remember one transfusion officer saying at the end of the Italian campaign that he thought he could keep any severe limb injury alive as long as they did not develop anuria or fat embolism later. I do not think that the forward surgery in this war was very different from the forward surgery

performed towards the end of the first world war. In this war it was the transfusion officers and probably improved anæsthesia which lowered the mortality and allowed more severe injuries to be dealt with.

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MENINGITIS WITH MULTIPLE PYOARTHRITIS (MENINGOCOCCAL).

BY

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Two cases of this extremely rare condition have recently been encountered and are considered of sufficient clinical interest to warrant publication.

Case I.—In July, 1945, an Indian labourer was admitted to hospital on what was apparently the fourth day of a febrile illness. He was fully conscious and able to give a good account of the features of his illness. He was aged 32 years and had until joining the Army six months previously lived as a farm worker in Orissa, and apart from the occasional bout of fever had always enjoyed good health. Four days previously he had complained of fever but not of such severity as to cause him to report sick. On the third day of fever he complained of severe headache and pains in all the joints, and it was with these complaints he was admitted to hospital.

On admission temperature was 98° and pulse-rate 84 per minute.

General nutrition was good and there was no rash and no enlarged glands were palpable. Tongue was furred and teeth carious. Liver and spleen were not palpable.

Chest revealed no abnormality while heart was not clinically enlarged and sounds were regular and pure though muffled. B.P. 120/70.

Joints.—Patient complained bitterly of pain in all joints and passive movements were forcibly resisted. While there was no local heat or redness of affected joints there was clinical evidence of effusion into knee, ankle and elbow joints.

Examination of nervous system was rendered extremely difficult and observations were perforce restricted. Pupils were equal and reacted briskly to light and on accommodation. Abdominals were not elicited and plantars were flexor. Blood slide revealed no malarial parasites. Urine—no albumin. Prostatic smear—no pus cells seen. W.B.C. 15,900 with 84 per cent polymorphs.

Condition was regarded as an acute polyarthritis and heavy salicylate therapy prescribed.

Some seven hours later temperature rose steeply to 106° and patient lapsed into coma.

Pupils now showed a very sluggish response and there was marked head retraction while plantar response was extensor.

Lumbar puncture revealed a frankly purulent fluid under increased pressure. Cells 17,400 (polys. 90 per cent), protein 211 mg., chloride 640 mg. sugar absent. Gram-negative intracellular diplococci were seen on smear and later cultured. A blood smear taken at this time and stained Leishman's showed considerable numbers of diplococci while from blood culture *N. meningitidis* was isolated.

Penicillin was given intrathecally (30,000 units) and three hourly (15,000 units) intramuscular therapy initiated. Soluble M & B 693 2 gm. were given intravenously and 1 gm. two hours later while with an indwelling Ryle's tube 1 gm. sulphadiazine was given four-hourly.

Coma, however, deepened steadily and with terminal pyrexia of 108° patient died twenty-four hours after admission to hospital.

Post-mortem was carried out four hours after death:—

"The body was that of a young man of about 30 years in a well-nourished state. Rigor mortis was present in the jaws and limbs. No marks of external injury were noted. There were no petechiæ on the skin. The pupils were dilated.

"*Central Nervous System.*—The meningeal vessels were congested and the convolutions had flattened appearance. The surface of the brain was covered in a purulent exudate which was seen to be filling the subarachnoid space; the exudate was heaviest at the base and filled the interpeduncular space. On opening the ventricle no distension was noted. The choroid plexuses were hyperæmic and the ependymal covering was dull and appeared denuded in parts. The exudate appeared much more purulent in the subarachnoid space than in the ventricles. Smears taken from the fluid showed the presence of Gram-negative intracellular diplococci morphologically resembling *N. meningitidis*.

"*Respiratory System.*—The lungs appeared intensely congested with a patchy consolidation and the pleuræ were covered with a flaky purulent sticky exudate.

"*Cardiovascular System.*—The pericardial sac contained about 25 c.c. of a purulent fluid, the stained deposit of which showed meningococci intra- and extracellular. The heart was in a state of diastole, the visceral pericardium showed diffuse petechial spots scattered all over the surface of the lining membrane. The right atrium and ventricle contained large dark P.M. clots. No lesions were noted in the endocardium and the valves were free from vegetations.

"*Alimentary System.*—There appeared a slight hyperæmia of the small intestines. The lymph follicles were not swollen. The liver showed pale areas which stood out in contrast to the rest of the organ. The cut surface of the organ was pale with indistinct lobules.

"*The Spleen* was about two and a half times its normal size and firm in consistence. The cut surface was intersected with old fibrous trabeculæ and in parts the pulp appeared soft.

"*Blood smears* made before death showed a few Gram-negative intracellular diplococci (*N. meningitidis*).

"*Urogenital System.*—The kidneys appeared acutely congested and swollen with a parboiled appearance. No lesions were noted in the bladder prostate or urethra.

"*The Suprarenals* showed cortical hæmorrhages.

"The knee, elbow, ankle and shoulder joints were opened and all these joint cavities were found to be filled with a thick viscid creamy pus which poured out on incision into the cavity. Smears made from the pus showed large numbers of Gram-negative intracellular diplococci.

"*Diagnosis.*—Meningococcal septicæmia with a widespread involvement of the joint cavities, pleuræ, pericardium and meninges."

Case II.—Within a few days of the previous case a second labourer, also Indian and from the same unit, was admitted in a semiconscious state. No previous history could be obtained but onset of symptoms was probably not more than a few hours before admission. Temperature was 102° and pulse 110 per minute. There were classical signs of meningitis with marked head retraction, positive Kernig, plantars extensor. Heart sounds were pure—of fair quality with B.P. 116/70. Chest revealed no abnormality.

There was noted to be an effusion into both knee-joints, left wrist and left ankle. No other joints appeared to be involved. Lumbar puncture revealed a purulent fluid under pressure. Cells 26,000, protein 664 mg. Chlorides 640 mg. sugar absent.

Gram-negative intracellular diplococci were seen on smear and later isolated in culture: W.B.C. 28,000 with 91 per cent polymorphs. Treatment was initiated with sol. M & B 693 2 grm. intravenously and M & B 760 2 grm. orally with 1 grm. two hours later and 1 grm. thereafter four-hourly. Patient was nursed in a sitting position and fed by indwelling gastric tube. Eight hours later there was no evidence of improvement and patient was now comatose and incontinent of urine and faeces. Repeat lumbar puncture showed no change in character of fluid. Penicillin therapy was not initiated, 15,000 units being given intrathecally (once only) and 15,000 units three-hourly intramuscularly. Sulphathiazole was continued orally. Twelve hours later condition had improved and patient was able to drink. Right knee-joint was aspirated and some 5 c.c. of pus obtained—this showed Gram-negative intracellular diplococci; culture, however, proved sterile. During the next six days penicillin 15,000 units three-hourly (total 780,000 units) and sulphathiazole 1 grm. four-hourly (total 36 grm.) were given during which time a steady improvement had been maintained. The joint condition, however, appeared to be little altered though pain on movement was much less. During the following week the swelling of left ankle and left wrist subsided while a small quantity of fluid persisted in both knee-joints. Apart from a bilateral nerve deafness no residual meningeal signs remained. On the twenty-fourth day of illness when convalescence appeared to be well established evidence of acute myocardial failure suddenly appeared and in spite of all efforts patient died with a terminal ventricular fibrillation.

Post-mortem was carried out within an hour of death:—

"The body was that of a well-nourished young man of about 28 years. No marks of external injury or violence seen. The pupils were normal in appearance and rigor mortis was absent.

"*Cardiovascular System.*—The most striking feature was the enormously dilated heart. The pericardium was normal in appearance and the sac contained about 20 c.c. of clear serous fluid. The right atrium and ventricle were engorged and dilated and the cavities contained unclotted blood. The left ventricle was displaced downwards and outwards and its interior contained a large dark P.M. clot which was adherent to the wall of the cavity. The mitral valve was stretched and admitted four fingers with ease. The myocardium was unusually pale and flabby and the ventricular wall thinned. No lesions were seen in the endocardium and at the bases of the great vessels.

"*Respiratory System.*—The lungs were congested and the pulmonary vessels engorged.

"*Alimentary System.*—The stomach and intestines showed a slight congestion of the superficial vessels and mucosa.

"The liver was of a dark purple hue and on incision poured copiously with blood.

"The spleen: Acute venous congestion was the feature here.

"*Urogenital System.*—The kidneys showed acute venous congestion.

"*Central Nervous System.*—The brain appeared slightly oedematous. There was no macroscopic evidence of recent inflammation in the meninges except at the base in the region of the optic chiasma where the meninges showed evidence of residual inflammation.

"*Joints.*—Examination of the joint cavities showed a smooth shining synovial membrane and articular surfaces with a clear synovial fluid.

"*Diagnosis and Conclusion.*—A case of meningococcal meningitis associated with a meningococcal polyarthritis (resolved). No trace of septic inflammation was evident at the P.M. The appearance of the heart suggested that the cause of death was from a weakened myocardium leading to enormous dilatation and ending in ventricular fibrillation."

Two fatal cases of meningococcal meningitis with pyoarthritis have been described. In the former, a fulminating pyæmia, all serous cavities were involved while in the latter a selective distribution was shown.

The post-mortem appearances of the relatively untreated and of the treated contrast strongly and provide proof of the efficacy of the therapy adopted.

SUMMARY OF INVESTIGATIONS.

	Case I	Case II
<i>C.S.F.</i>		
Character	Purulent	Purulent
Cells	Polys.	Polys.
Protein	211 mg.	644 mg.
Chloride	640 mg.	660 mg.
Sugar	Absent	Absent
Smear	Gram-negative diplococci	Gram-negative diplococci
Culture	<i>N. meningitidis</i>	<i>N. meningitidis</i> (After initiation penicillin therapy)
<i>Joint Fluid</i>	(Post-mortem)	
Character	Purulent	Purulent
Cells	Polys.	Polys.
Smear	Gram-negative diplococci	Gram-negative diplococci
Culture	<i>N. meningitidis</i>	Sterile
Blood culture	<i>N. meningitidis</i>	Sterile
Blood smear	Gram-negative diplococci	No organism seen
W.B.C.	15,900	26,000
Polys.	84 per cent	91 per cent

*Annals of the Past.***THE ENGLISH ARMY SURGEON IN THE SIXTEENTH CENTURY.**

BY

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THE sixteenth century is of great interest to the military historian on account of the many developments which took place in arms, tactics, and organization. From the medical and surgical viewpoint, the period is of importance because gunshot wounds now, for the first time, became the normal type of battle casualty. Besides this, however, the age is of significance on account of the status of the military surgeon. No one can maintain that his position in the social scale was a very high one, but it can be said that it was better than it had been in the previous centuries, and that the leaders of the trade, for surgery at that time could hardly be called a profession, were consciously and conscientiously attempting to raise it in the public esteem by the education and supervision of its practitioners.

To understand the status of military medicine and surgery in England during the sixteenth century, it is necessary to turn back to the preceding ages. Like many other arts and sciences, medicine during the Dark Ages had deteriorated and fallen away from the high standard which it had attained in the classic times of Greece. Surgery had been torn from medicine and had become a separate branch of knowledge, or lack of knowledge, and while medicine had remained in the hands of men of education, surgery had fallen to the care of charlatans, mountebanks, and the rag-tag of humanity. This disastrous state of affairs was due largely to the influence of the medieval Church, which hated the shedding of blood, at least by ecclesiastics. It, therefore, first of all discouraged, and later prohibited, the clergy from performing any operations that might cause the shedding of blood, and thus, for all intents and purposes, cut off from the practice of surgery the great majority of the educated men of the time.

The physician of the Middle Ages, usually a cleric, and always a university graduate, treated only internal diseases, and would never have thought of soiling his hands, or losing his caste, by dealing with surgical conditions. He was not, even judging by the lowest of standards, a very good practitioner, and when compared with the men of ancient Greece he was thoroughly bad. His clinical training had been negligible, indeed one could get a degree without ever having seen a sick man. The study and practice of physic was purely traditional; what certain ancient fathers of the art had written or said were the eternal verities, and any other opinions were false, heretical and worthy only of damnation. Original research was therefore useless, nay worse, it was

sacrilegious; the less one had to do with it the better, and all would be well in the world of medicine.

Of the ordinary practitioners in surgery enough has been said; if they had been the only men interested in the subject, the future of surgery would have been entirely without hope; fields of battle would have continued to be very grim places indeed, where a wound was practically the equivalent of death. Fortunately there were other surgeons of a more honest character. The humblest of these were the barbers who, besides cutting hair and trimming beards, were the recognized drawers of blood and extractors of teeth for the community in general. As time went on many of the more ambitious of these craftsmen extended their field of interest, and undertook the treatment of cuts and wounds, and performed various minor surgical operations. On a higher plane there were a few men of some education who, if they did little to advance the knowledge of surgery, at least prevented that knowledge from being completely lost. Their numbers were few, and although they were probably not very skilled, nevertheless, they were conscientious practitioners of their craft. The greater number of them had learnt their surgery in that great school of experience, war, which school had been recommended by no less an authority than Hippocrates. It was on active service that the surgeon previous to the sixteenth century—and indeed for two centuries afterwards—gained his knowledge and experience. In England the most famous of these was John of Arderne, who learned his trade in the Hundred Years War, and later settled in Newark as a surgeon. He must have been a man of considerable attainments, for he was treated by the physicians as an equal, and held by them in the highest esteem. In 1370, at the age of 67, he moved to London, where he joined the Guild of Surgeons, the members of which had graduated in the school of war (Graham, p. 118).

Yet even he is not the first of our military surgeons, for a list has been preserved of the medical staff of the household of Edward I, which contains the names of Philip de Belvaco, Edmund de Baunton, and Master Peter. The first of these was surgeon to the King, and he had a similar status to the King's physician, John de Kenle, namely that of a "Miles simplex," with the pay of 2s. a day. De Baunton was an assistant to de Belvaco, and he and Peter—described simply as "Cirurgicus"—received 1s. a day, the salary of a serjeant or mounted lancer. The surgeon was paid for his instruments, and the physician received a subsistence allowance when he was absent from the courtier's table. Over and above these payments, the physician and the surgeon, with their assistants, were each allowed a horse. Altogether the household medical staff of Edward I consisted of the physician to the King and his two assistants, the surgeon to the King and his two assistants, one other surgeon, and finally the apothecary to the Queen.

It is improbable that the King went to the expense of taking all these physicians and surgeons on active service, simply to look after himself and his personal bodyguard; indeed Smart (pp. 140-1) shows that the reverse was the usual practice. He states that in the autumn of 1299, de Belvaco and his two assistants were with the Army, and that in September and October, 1301, the

assistants of de Kenle were in Scotland. From this it must be inferred that the other medical members of the Household were not in the field on these two occasions.

It is obvious that the medical members of the King's Household were more than adequate for the task of looking after the King and his Household troops. We have, however, no information as to the medical care available for the rest of the Army. No doubt the great nobles engaged surgeons for themselves and their own personal retinue, much in the same manner as the King did for the Royal Household. Whether any medical or surgical assistance was provided for the ordinary rank and file of the levies is also unknown. Howell (I, p. 118), quoting from the Wardrobe Accounts, informs us that several years later, in 1322, during the reign of Edward II, the Welch Corps had surgeons upon their establishments. It is, therefore, possible that in the time of Edward I similar appointments were also made. It must not be imagined these surgeons of the Welch levies had anything like the status of those of the Royal Household, they only received 4d. or 6d. a day, a wage similar to that of the rank and file of the Army, and they were probably men of humble station. Presumably they must have been barbers or worse, for the Guild of Surgeons, which has already been mentioned, never had more than twenty members, and frequently its numbers were less. After the nobles had had the pick of these, there could have been very few left for the rest of the Army. Some other source must have been tapped, and the only choice left was between barbers and quacks and mountebanks.

Some light is thrown upon the standing of the medical men who followed the Armies of Edward I, in a note in the Calendar of Chancery Warrants 1244-1326. Here under the date March 3, 1317, it is reported:—

"That Henry le Leche has long stayed in Scotland attending to the people who have been wounded there on the service of the King's father and the King, and the King wishes to provide him sustenance for life. Mandate to look to what place of the realm the King can let him have sustenance, in abbey, priory, hospital, or other house of religion, and make letters for him."

From this extract, one would infer that Henry the leech was of no very high social position, if a beadsman place was good enough for him; neither does it appear that a long period of military service was a very profitable pursuit for the lower ranks of the medical profession of those times.

Little is known of the medical officers who assisted in the earlier part of the Hundred Years War. But in the latter portion, which began in the reign of Henry V, the King entered into contracts with Nicholas Colnet, physician, and with two surgeons, Thomas Morestede and William Bradwardyn (Howell, I, 121-2). It may appear curious that such a means should have been adopted in engaging medical men for service in the wars, but it will be explained, if we study the changes which had taken place, during the fourteenth century, in the method of raising troops for foreign service.

During the wars of Edward I it was soon discovered that the feudal levy, by which practically everybody could be called up for forty days' service in one year, would not work in a prolonged campaign, especially if it took place at a distance from the homes of the soldiers. Edward I got over this difficulty

by arranging with his tenants in chief that they should only bring a proportion of their mounted retainers with them into the field; and that instead of serving for only forty days with the whole of their followers, they should continue in the field for a much longer period with a smaller number. In regard to the infantry, the commissioners of array were instructed to call up a small number of men at a time, and to send forward drafts, at regular intervals, to take the place of the men whose term of service had expired.

For the war with France Edward III, with the experience of his grandfather to guide him, carried the system of contracts further, and entered into regular agreements with his tenants in chief and others who were in a position to raise soldiers, for the supply of a certain number of men for a lengthy period. This method was also adopted by Henry and it was this type of contract he entered into with his three principal medical officers. Each had an agreement which contained these common features, each of them would receive 1s. a day, and would supply three archers who would be paid 6d. a day. Over and above this, the contractor was to be allowed to retain all the booty, up to the value of £20, that he might collect by plunder, or money up to the same amount obtained by ransoming prisoners of war. Over £20, one-third of the value was to go to the King. In the contract of Morestede, the principal surgeon, there was an additional obligation to supply twelve assistants, "*hommes de son mestier*" (Howell, I, 121-2).

Morestede and Bradwardyn, like their predecessor John of Arderne, were members of the Guild of Surgeons. This body was instituted about the middle of the fourteenth century, and was followed, a few years later, by the foundation of a similar body by the barbers, which consisted of two types of members: those practising barbery, and those practising surgery.

In 1419 Peter Henewer was appointed to attend the King in Normandy as his physician (Devon).

During the reign of Edward IV, his physician Jacob Fryle, or Fryse, went with the Army to Normandy, at a salary of 2s. a day. He was accompanied by two servants at 6d. each *per diem*. William Hobbes, Physician and Surgeon to the King's body, was also employed upon this campaign. To assist him there were seven other surgeons at 1s. a day, and five at 6d. a day (Howell, I, pp. 123-4). This is a much more adequate medical staff than those that had been engaged for previous campaigns. We now observe that a medical hierarchy is developing in the Army, consisting of various grades commencing with the physician at a salary of 2s. daily, and descending to the lowest rank of surgeons with the small pay of 6d. a day. There is, however, one surprising feature in this organization, and that is that there should have been fewer surgeons at 6d. a day than there were at 1s.

In 1481-2 Hobbes was once more employed on active service, and was ordered, by the King, to join the Army of the Duke of Gloucester in the North of England. His rate of pay was 2s. a day, 6d. more than he received in Normandy. He had a staff of eight surgeons, who received 1s. a day; and an unspecified number who got 6d. a day (Devon, p. 503). The medical arrange-

ments for this campaign therefore were similar to those for the expedition to Normandy in 1475.

From this account it will be seen that in the English Army, the senior medical officers received good salaries, which would enable them to maintain the status of an officer. Lower down the scale, however, there were men, whose standing was little or any better than that of a common soldier. Below this there were numerous camp followers, who had no status whatsoever, and, from their lack of surgical knowledge, little deserving of any.

By the end of the fifteenth century the relationships between the surgeons and the barbers had become more friendly, and in 1493 an agreement was made whereby the surgeons were granted all the privileges of the Barbers' Company, except the freedom of that company. In 1540 the agreement was carried to its logical conclusion by the union of the barbers and the surgeons into one company called the Barber Surgeons' Company; a union which continued for over two hundred years.

In 1511 Parliament passed an Act prohibiting any person from practising medicine or surgery in London without having been licensed by the Bishop of London or the Dean of St. Pauls. These authorities were only allowed to issue these licences to candidates who had passed suitable tests before properly qualified examiners. In the Provinces similar licences were to be issued by the bishops of the different dioceses.

This was an admirable act, and if it had been put strictly into force, would have been invaluable in raising the standards of the medical profession, and would have been of great benefit to the members of the public, by protecting them from quacks and charlatans. These gentlemen, however, have always been the spoilt favourites of the British legislature, and within a few years Parliament undid all the good it had previously done by passing an Act that stated that nothing in the statute of 1511 was to prevent herbalists from carrying on their trade. This meant that anybody, provided that he called himself a herbalist, could practise medicine without control or interference. Towards the end of the century, the great military surgeon Gale complained bitterly of the state of affairs brought about by this piece of legislation (Gale, pp. 37-8).

However, Act or no Act, the barber surgeons set to work to put their house in order, and made every effort to raise the educational qualifications of the members and apprentices of the craft. They organized systematic courses of lectures; they drew up regulations for the supervision and examination of apprentices; they laid it down that these youths must be able to read and write, and should know a little Latin. Before apprentices were made members of the company and given their licences to practise, they had to pass an examination to test their knowledge of the craft of surgery. After they were qualified, they still had to attend the public lectures of the company, to insure that their knowledge did not become rusty.

It can, therefore, be said, that in London the standard of surgical practice was reasonably high; in the Provinces things were less satisfactory, and many of the surgeons must have been very ignorant, yet even here there were men who were anxious to improve their knowledge, and joined the barber surgeons

as "foreign members." Which shows that the company was doing good work, and that membership of that body was considered to be a valuable qualification.

Outside the craft quacks continued to flourish. Gale describes them as:—

"The rabble of rude empiricks (and drosse of the earth, which when they cannot otherwise live, chop straight waies into the art of chirurgerie) be no chirurgions, but manquillers, murtherers, and robbers of the people: such are some hosiers, tailours, fletchers, minstrells, souters, horseleeches, juglers, witches, sorcerers, bawdes, and a rabble of that sect, which would by lawes be driven from so divine an art, the exercise of which, for want of knowledge bringeth sometime losse of member, sometime of life, and sometime both of limme and life."

The venerable Gale had a grand gift of vituperation, and never had any difficulty in calling a spade a spade.

This "rabble of rude empericks" is of importance, because many of them found their way into the Army, and their ignorance often proved fatal to the poor unfortunate wounded soldiers who came under their care.

So much for the surgeon; and now for the Army in which he served. During earlier centuries, it had consisted of parties varying in numbers, supplied either by individuals by contract, or from the counties by levies. These parties were brought together as an unorganized mass and grouped into three large formations called, vanward, mainward or battle, and rearward. Their names indicate the positions the formations took up on the field of battle. In column the vanward occupied the front line, behind it came the battle or mainward followed by the rearward. When the Army was in line, the vanward and rearward were on the right and left flanks, and the battle was placed in the centre of the line.

Towards the end of the fifteenth century a new sub-formation came into existence, called the company. This consisted normally of about 100 men under the command of a captain, assisted by two other officers, a lieutenant and an ensign. At times the companies had a larger establishment, and might even reach a strength of 400, but this was unusual.

In the early part of the sixteenth century the Army continued to be divided into the old formations of vanward, battle and rearward, but their positions on the battlefield were no longer rigidly fixed. A formation took up whatever position was the most convenient, and the rearward might find itself in the front of the column; while in line, the battle might be ordered to take up a position on one of the flanks.

These formations were now divided into a large number of companies, which must have made administration slightly easier than in the old days when there were no such units. But this improvement was neutralized by the increasing size of the armies, and it was found to be extremely difficult to administer the higher formations, divided up into a large number of companies. Some unit, intermediate in size, was obviously required, and this was at first obtained during a battle by grouping a number of companies under the command of an officer specially nominated for that purpose. Later this temporary arrangement became permanent, and several companies were united together to form a regiment under a permanent commanding officer called a colonel. England, being always rather conservative in military matters, did not introduce the regiment until well on in the reign of Queen Elizabeth.

From what has been said of the organization of the Army during this century, it follows that medical officers in the early part of the century could only have been attached either to the higher formations, such as the battle, or to the companies. Nothing in the way of a regimental medical staff could have been possible until the latter part of the century. Actually in the English Army there were no company surgeons during the first half of the century. On the Continent the establishment of the company had included a surgeon from an early date, but in England there is no evidence of the existence of such an officer until 1556. In that year the Master of the Barber Surgeons petitioned the Lord Mayor that his Company might be exempted from providing soldiers, because, in time of war, they were compelled to supply a surgeon, with a man to attend him, for every hundred soldiers in the Army (Young, p. 100).

Further we are informed by Howell (ii, p. 609), on the authority of the Harliean MS. 6844, that the surgeons for the Army at St. Quentin were supplied on this scale of one surgeon for every hundred soldiers, both cavalry and infantry. It will be noted that in neither of these references is any mention made of companies, and it may well be that the surgeons were supplied as a pool to the C. in C., who distributed them throughout the Army as he thought fit. This suggestion is to a certain extent supported by the allusion of the Master of the Barber Surgeons Company to a man to attend upon the surgeon. As far as I have been able to discover, this is the only reference to such an individual. There is certainly no mention of such a man in any of the company establishments that I have examined. Does this not suggest, that as long as the surgeon was not attached to a company, it was considered necessary that he should have an assistant, but afterwards, when he became a member of a company, he would be able to get whatever aid he might need from the unit itself, and save the State the expense of providing him with a special assistant. Therefore, although the evidence is but slight, there does appear to have been a stage when surgeons were provided at the rate of one to every hundred men, before they were actually allotted to specific companies.

The earliest evidence of the existence of company surgeons in the English Army is to be found in the Calendar of the Carew Papers. This contains a series of instructions to the Lord Deputy of Ireland. Those of March 20, 1558, enumerate the retinue of that official, and make no mention of a surgeon in his company (C.C.P., 1515-74, pp. 272-3). Those of July 17, 1559, however, for the first time, show that the Lord Deputy's company now had a surgeon on its establishment (*ibid.*, p. 285).

By 1571 the practice of having a company surgeon was becoming common, during that year, in the Earl of Sussex's Army in Scotland, many of the horse companies and most of the foot companies had their own surgeons (Foljambe, p. 9). From now to the end of the century, the normal establishment of the company always contained a surgeon.

It is not to be assumed that all the companies always had surgeons, this was far from being the case, and there were frequent complaints of the absence of these officers. There may at times have been difficulties in finding suitably qualified men, and mention of this is made by Gale who blames the Act that

allowed herbalists to practise without control, for this shortage (Gale (a), pp. 37-8), but one of the principal reasons was the gross corruption of the company commanders. These gentry looked upon their companies as little gold mines, out of which they could make money quickly and easily. It mattered little to them whether this money came from cheating the State or robbing their soldiers. One of their methods was to keep the surgeon's post vacant and to pocket the pay and other perquisites of that office. If it became necessary to face an inspection by a muster master that was not bribable, a highly improbable contingency, the captain employed someone to act as the surgeon until the inspection was over. To defeat this trick, the government, when the Lough Foyle expedition was mobilized, issued instructions that if there was any suspicion that the company surgeon was not a genuine practitioner, he should be compelled to take an oath that he was a qualified surgeon (A.P.C., 1598-9, pp. 21-2). But it is to be feared that this did little to stop this form of roguery.

According to Cruickshank (pp. 121-2) on the authority of the Cottoc MSS., the Privy Council, to improve the Medical Services of the regiments, abolished the company surgeons, and in their place substituted two surgeons to each regiment. These officers were to receive 5s. a day, but out of this sum they had to pay the wages of any assistants that they might employ. There seems to be no record of this instruction in the published Acts of the Privy Council, and it was certainly not put into force universally. There is no indication that the four regiments sent to France in 1589 had anything but company surgeons (A.P.C., 1589-90, p. 122) and there is plenty of evidence to show that company surgeons continued to serve throughout the remainder of the century and well into the next one. But the regimental surgeon did exist, and Sir John Norreys had one when his regiment was on the Continent, and also when that unit came over to Ireland in 1595. This officer continued in employment there until the winter of 1597, when he returned to England. After his departure the Earl of Ormond appointed two surgeons in his place. Sir Samuel Bagenall's regiment also had a regimental surgeon, but no officer of this standing was attached to the troops in Munster or at Carrickfergus (C.S.P.I., 1601-2, p. 242).

The next matter to be discussed is the method of recruitment of the Army surgeon. In the reign of Henry VIII there are a number of references to the engagement of surgeons, but whether voluntarily or under compulsion is uncertain. By the time of Queen Elizabeth there is no doubt whatever as to the method of supply; surgeons were pressed or conscripted just like any other non-commissioned officer or man. The selection of these recruits was largely in the hands of the Barber Surgeons Company, but, frequently, authority was given to company commanders to press surgeons for their companies.

The authority under which the barber surgeons acted is contained in a document dated December, 1559, which runs as follows:—

"Elizabeth by the Grace of God, etc. etc.

"We lett you wote that for certeyn considerations us movinge we have be theise presents autorised and lycened our Trustie and Well-beloved Servaunte Thomas Dycary Sergeante of our Surgions and the Wardens of the Fellowship of the said Surgeons within our Cytie of London that now be or hereafter shalbe, that they by themselves or their assigne bearer hereof shal and may from henceforth within any other Cytie

Town Boroughe or other place within this our Realme as well franchised and privileged as not franchised nor privileged such and as many Surgions as they shall think mete and able from time to time to doe unto service in the syence of Surgerie at any season hereafter as well by sea as land and further that the Sergeant and Wardeyns aforesaide shal or maye take of suche as be not able to serve suche instruments and other stuff of Surgerie as they shall think mete to serve agreing and payinge therfor to all suche of whom any suche instruments or stuff shall be taken. Wherefore We will and command you and evy of you that unto our saide Sergiant and the Wardeyns and their assigne bearer hereof in the due execution of this our auctoritie and lycense ye be aydinge helpinge and assistinge as oft as the case shal require without any your denyall lett or contradycion as ye and evy of you tender our pleasure and woll avoide the contrary at your peril" (Young, pp. 313-4).

How the governors of the company performed this duty can be seen from entries in their archives. On December 7, 1598, they received orders from the Privy Council to press a surgeon for service in Ireland. Acting on these instructions they selected one John Cumberland and handed him over to his appointed captain. At the same time "four or five other surgeons were also pressed and handed over *"nolens volens"* (*ibid.*, p. 321). There was, in the sixteenth century, quite as strict a conscription of a part of the medical profession as was in force during the two great wars in the first half of the twentieth century.

An incident in connexion with one of these conscripted men illustrates a point made earlier in this paper, that the absence of company surgeons was frequently due to the deliberate neglect of the company commanders. This man, Dominick Lomeline, was brought up before the Master of the Barber Surgeons on January 16, 1599, and voluntarily confessed that he had managed to get "discharged of his press" at the cost of twenty nobles (noble = 6s. 8d.), of which sum the captain of his company had had £3 in cash (*ibid.*, p. 321). This is an excellent example of the corruption of the captains of that time, who never lost an opportunity of making money out of their companies. No doubt this officer went off on active service without a medical officer, and pocketed his wages.

Frequently the captains were left to find their own surgeons, and several examples of authority to do this will be found in the Acts of the Privy Council. Here are two entries, the first of July 23, 1593:

"A Placarde for every of the saide capitaines (10) directed to all public officers requyringe them to give their assystance to the capitaines in takynge up and ympress-image two drommes and a surgeon to be ymployed in theire bandes, not beinge servants of any nobleman" (A.P.C., 1592-3, p. 416).

The second example dated September 7, 1598:—

"An open warrant to all Her Majesty's publick officers requiring them to aide and assiste John Bingham (auctorised thereto by Sir Richard Bingham) to imprest two drums and one surgeon for the use of his company which is to goe into Ireland" (A.P.C., 1598-9, p. 135).

Though these high-handed methods of conscription were employed without hesitation in recruiting the rank and file of surgeons for the Army, the leaders of the craft received very different treatment. William Pickering, Surgeon of Saint Bartholomew's Hospital, was appointed by Lord Burgh, Lord Deputy elect, to accompany him as his personal surgeon to Ireland. The Privy Council

wrote to the Governors of that institution informing them of this appointment and asking for their approval. The Council also requested the hospital authorities to allow Pickering to select a suitable person to act as a locum tenens during his absence. And at the same time they asked that Pickering might be re-employed on his return, at the same salary, fees, and other emoluments that he at present enjoyed (A.P.C., 1596-7, pp. 521-2).

The next point to be considered is the pay of the surgeon during this period. It has already been shown that in the fourteenth and fifteenth centuries, the senior men received 2s. a day and the most junior 6d. In the early part of the century no alteration was made in the pay of the higher ranks, but improvements occurred in the remuneration of the inferior officers.

In 1513, the two surgeons that accompanied Lord Surrey's expedition to Scotland received 8d. a day, which was the same pay as that of the ordinary archer. This indicates that the junior surgeons of the Army only ranked with a simple private (L.P., H., VIII, I, p. 649).

Five of the surgeons attached to Lord Lisle's force in 1514 also received 8d. a day, but the senior man, a Spaniard, was paid the customary 2s. of the higher ranking officer (*ibid.*, I, pp. 721-2).

In August, 1523, the establishment of the expeditionary force, under the command of the Duke of Suffolk, included a Master Surgeon at 2s. a day and eight other surgeons at 10d. It is probable that these men were attached either to the train of the general or to the cavalry. In the same force a Master Surgeon was attached to the Ordnance or Artillery at 1s. a day, and two other surgeons who received 10d. (*ibid.*, III, pt. 2, pp. 1370-2).

By 1546 the status of the ordinary military surgeons had improved, and in the garrison at Le Havre they ranked as N.C.O.s along with the drummer, fifer, and chaplain, and received 1s. a day. This continued to be their pay during the remainder of the century (A.P.C., 1547-50, pp. 440-1).

This salary, even with the methods of compulsion then in vogue, was insufficient to obtain the number of surgeons required. In order to get them, it became necessary to supplement their pay by money from some other source. And, as usual, the source chosen was the pay of the unfortunate private soldier. Ralphe Smith informs us:—

"That every souldier at the paye day, do give unto the surgeon 2d 'as in tymes past hath beene accustomed', to the augmentation of his wages, in consideration whereof, the surgeon ought readilie to employ his industrie uppon the soare and wounded soldiers not intermedlinge with any cures to them noysome" (Scott, ii, p. 377).

When this monthly stoppage of 2d. from the pay of the soldier began is uncertain; in June, 1563, there was a shortage of surgeons at Havre, and the authorities of that garrison suggested that the surgeons should be given a small allowance out of the men's pay, as had been done in other garrisons (C.S.P., F., 1563, p. 434). It would therefore appear that this stoppage must have been in vogue at least some time before 1563.

Although the pay of the surgeon of an infantry company was only 1s. a day, there is evidence to show that the surgeon of a cavalry company received more. Fortescue declares that in 1557 the pay of the surgeon of a horse company was 2s. *per diem*, but this was not his normal salary during this period.

In the De Lisle and Dudley Papers (1,391) it is recorded that the surgeon of a Horse Company in Ireland was only receiving the customary 1s. a day. However, by 1571, the salary of a medical officer of a company of demi-lances of the English Army in Scotland was 1s. 6d. (Foljambe, p. 9). By 1591 it had been raised to 20d. in France (A.P.C., 1591, p. 229), but it was still only 1s. 6d. in Ireland in 1598 (*ibid.*, 1598-9, p. 165). Nowhere has it been possible to obtain any evidence that a company surgeon of cavalry ever got as much as 2s. a day during the sixteenth century.

The pay of the principal surgeons of the Army remained unaltered at 2s. for the greater part of the century. William Kelly, the surgeon-general on the Irish establishment, received this salary during the whole of his long service, which extended from before 1567 (De Lisle, I, p. 395) to the time of his death in 1597. His successor was Walter Newton, who received the same rate of pay. It would appear that this 2s. a day was in the nature of a retaining fee, and if called upon to do military work, the surgeon-general received a supplementary allowance (C.S.P., I., 1600-1, p. 242).

This description of Kelly as surgeon-general is possibly the earliest use of this title in the English Army, a title which was to have a long and honourable history, and was only to disappear during the war of 1914-18.

The appointment of regimental surgeon brought about an increase in the salaries of the more senior medical officers. The probable reason for this was that these men were employed full time, and had little opportunity of augmenting their incomes by private practice. The surgeon of Bagenall's Regiment in Ireland in 1599 received 6s. 8d. a day; (*ibid.*) and in the garrison of Lough Foyle in 1600 there were two surgeons at a salary of 10s. a day, but each of them had to provide three assistants out of this salary (*ibid.*, 1599-1600, p. 363).

During this century the standards expected from military surgeons were reasonably high, although their practice often fell far below this ideal. As early as 1514 it had been laid down that surgeons,

"have been exempt and discharged from all offices and business, wherein they should use or bear any manner of armour or weapon . . . as well in battels and fields, as in other places, therfor to stand unharnessed and unweaponed according to the Law of Arms, because they be persons that never used feats of War, nor ought to use, but only the business and exercise of their science, and to help and comfort the King's liege people in the time of their need" (Goodall, pp. 4-5).

At the end of the century Ralph Smith writes:—

"Surgeons should be men of sobriety, of good conscience, and skilful in that science, able to heal all soares and woundes, specially to take out a pellet of the same. All capitaines must have suche surgeons, and ought to see them to have all their oyles, balmes, salves, and instruments, and necessary stufte to them belonging, allowing and spareinge carriage for the same . . . Such surgeons must weare their baldricke, whereby they may be knowen in tyme of slaughter, it is their charter in the field" (Scott, ii, p. 377).

From these extracts it will be seen that the value of a good surgeon was fully appreciated during the sixteenth century, and that his privileges were in many ways comparable with those of the medical officer of the present day. He was a non-combatant, no doubt with all the advantages and disadvantages associated with that term; and he had a distinguishing badge by which he was

known not only to the troops of his own side, but also to those of the enemy; and by this badge he received protection in time of danger. There is every reason to believe that these conventions were as well observed as any in force at the present day.

The value of having a qualified surgeon in one's company, although acknowledged, was not always carried into practice by company commanders. As has been mentioned, corruption was widespread; if a captain could avoid appointing a surgeon, he was able to augment his own salary by pocketing that of the medical officer. Even if a company commander did supply a surgeon for his company, there was not the slightest guarantee that the man he selected would be in any way qualified for such an appointment. With so many rogues and charlatans in the country, it was odds against a captain, with little experience in medical matters, selecting a properly qualified man for the post of company surgeon. Unquestionably it was much better when the selection was left to the master and wardens of the Barber Surgeons Company.

Whatever may have been the cause, the skill of the average military surgeon left much to be desired. At the siege of Montreuil in 1544, the standard of surgery was so low that the Commander in Chief of the English forces, the Duke of Norfolk, was compelled to order some of his senior surgeons to inquire into what was happening, and to make suggestions to him for improvements. This committee made a thorough investigation and discovered a scandalous state of affairs. Many men were acting as surgeons who were totally unqualified for their positions, and who were incapable of performing the duties of that office. Some of them were treating wounds with grease, normally used for dressing horses' hooves; others cobblers' wax mixed with rust from old tins. When this was reported to the Duke, he had the whole of these rogues rounded up and detained in the Marshalsea. Then, having examined them and found that they were not trained surgeons, he ordered them out of the camp, informing them that should they ever return he would have them hanged (Gale (*a*), pp. 26-7).

In 1585 Clowes and Godorus, when with Leicester in the Low Countries, found that they were up against the same problem. In the Army there was a "Sort of stragglers, that did thrust themselves in to the capitaines bands, for principal masters in Surgerie" (Clowes, p. 111).

Probably one of the causes of the invasion of the Army by ignorant quacks was the shortage in England of sufficient qualified men to supply the number of surgeons needed for the Army. Gale complains of this shortage, and says, that while in the reign of Henry VIII he had no difficulty in obtaining seventy-two capable surgeons from London alone for the Army and the Navy; in 1586 there were not more than thirty-four surgeons of this quality in the whole of the country, and many of these were in the service of the nobility and could not be pressed for service. The cause that he assigned for the decrease in the number of suitable men was the influence of the Act of 1543, which permitted unqualified persons to practise without risk of penalty (Gale (*a*), pp. 37-8). It is possible that Gale may have exaggerated the shortage in order to emphasize the damage done by the Act, which he abhorred. But there are frequent

complaints from the Army of shortage of surgeons, and this was not always due to the carelessness of company commanders. Another difficulty was that few English surgeons had had active service experience, and had little knowledge of gunshot wounds (Cruikshank, p. 120). This would account for the complaints made by soldiers of the poor results obtained by their surgeons in the treatment of wounds (*ibid.*, pp. 121-2).

It is now time to consider the Army physicians. As in earlier centuries, they were employed in much fewer numbers than their surgical brethren. It is curious that there should have been such a small establishment of physicians; in campaign after campaign we read the same monotonous and melancholy accounts of disease and mortality among the troops; and a far greater number of men became casualties from sickness than from wounds. It has been suggested that the reason for this was, that when a soldier went sick, he was either handed over to the care of the civil population, or discharged and sent back to his home. This explanation is not a very satisfactory one, for similar treatment was given to the wounded, who had far more surgeons to look after them. Even during sieges, when epidemics were raging, and when it was impossible to evacuate the sick, commanders did not ask for reinforcements of physicians. This is well illustrated by the epidemic at Havre in 1563. Although the town was almost overwhelmed by disease, the Commander-in-Chief, the Earl of Warwick, was content to carry on with Dr. Julio, the only physician he had. It was only when this officer went sick that he asked for another physician and an apothecary to replace him (C.S.P., F., 1563, p. 438). In such a situation it must have been quite impossible for a single doctor to give anything like adequate attention to the wretched soldiers, who were going sick by hundreds, and dying at the rate of 50 to 60 a day. One is tempted to ask whether the surgeons were not called into help in such an emergency, but there is not the slightest indication to show that this was ever done; and there is no evidence that during this century the military surgeon made any attempt to trespass on the preserves of the physician.

Little information is available as to how the physicians for the Army were obtained, but it was certainly not by compulsion. The physicians were gentlemen and were thereby exempt from impressment; their services could therefore only be obtained by voluntary enlistment. It is possible that suitable men were selected by the College of Physicians, when they were needed: this was certainly the method adopted in selecting a physician for service in Ireland in 1573 (A.P.C., 1571-5, pp. 134-5).

This Irish appointment was designated physician for the State and carried an allowance of £40 a year. The administration of Ireland at this period was in many ways analogous to that of a Crown Colony at the present day, and the Government physician might find himself called upon to act in both a civil and military capacity. He supplemented his allowance by what he could make out of private practice. For some years the appointment was left vacant, but was ultimately filled in 1594 by Dr. Atkinson, and after his death by Dr. Turner. When the latter died, the stipend was given to the Master and Fellows of the

College at Dublin, who presumably filled the vacancy, but no mention is made of this (C.S.P., I., 1600-1, p. 242).

Information about the physicians on the staff of the armies sent to the Continent is even poorer. Oman informs us that the King's physician, Dr. Butts, accompanied Henry VIII on the expedition to France in 1544 (Oman, p. 331), and there are a few scattered references to Army physicians in the documents of that century. Mention has already been made of Dr. Julio at Havre in 1563. In 1587 Lord Willoughby asked for an allowance for a chaplain, chief secretary, physician, and surgeon in connexion with his colonelcy (C.S.P., F., 1587, p. 96). On October 29, 1591, Henry Killigrew wrote from Dieppe to the Earl of Essex informing that peer that his physician, J. Muffett, had arrived that day in the "*Tremontana*" (Salisbury, iv, pp. 154-5)—and that exhausts the evidence. It would almost seem that there were fewer physicians on the establishment of the Army during this century than in the one preceding it. It is appreciated that in the Low Countries, where much of the fighting took place, that hospitals (Guest Houses) were fairly numerous, but these must have been quite incapable of dealing with the large numbers of sick accumulating from armies on active service. It is therefore obvious that the solution of the problem, of how and by whom the sick of the English armies were treated in the sixteenth century, must remain unsolved until further evidence is available.

Little mention has been made in this paper of the third branch of the profession, namely the apothecaries, indeed there is little to be said. It does not appear that they were employed to any extent in the English Army during this century. But from the few allusions to them, it seems that they took a more active part in the practice of medicine than is generally imagined. The usual view is summed up by Barrett (p. xvii), who writes:—

"The conclusion to which one seems bound to come with regard to the position of the early apothecary is this; namely, that originally in the days when he was incorporated with the grocer (1606), he sold in his shop what drugs he could get, and possibly other things, certainly sweets and preserved fruits. Later again when separated from the grocer (1617) he sold drugs as does the chemist at the present day; but the chemist did not then dispense as he does now—this was the province of the Apothecary. Later again, the Apothecary both prescribed and dispensed, and finally became what he is now, the fully qualified and licensed practitioner."

Allusions to the apothecaries in connexion with the English Armies are very rare indeed during this century. But they do suggest that even at this period he was already prescribing and competing with the physician.

When the physician at Havre went sick in 1663, the Earl of Warwick not only asked for another physician, but at the same time especially asked that one Colff, an apothecary from Cornwall, should also be sent over to Havre; because he was a man "who had experience in *curing* the diseases reigning among them" (C.S.P., F., 1563, p. 438).

Thomas Smith was for many years an apothecary in Dublin; he was certainly there as early as 1566 (C.S.P., I., 1509-77, p. 299). In 1593 he was preparing to go to London, armed with letters of introduction from various influential men in that city to Walsingham. From these letters it can be gathered that Smith was actively engaged in the practice of medicine. Indeed, Wallop in his

letter to Walsingham says that he wants him back as soon as possible, as he requires his professional services (*ibid.*, 1574-85, pp. 498 and 501).

These are the only references to the apothecary in military service, and even in these cases it is doubtful how far the men concerned were so employed. There is no evidence to show whether Colff ever went to Havre; and we only know that Smith practised in Dublin. No doubt officers of the Army sought his professional advice, but there is nothing to indicate that he was ever actively employed with the Army in that country.

The conclusion we must come to in regard to the medical personnel of the English Armies during this period is, that by the end of the century the strength of the surgical branch of the medical service was adequate for its work; but on the purely medical side the shortage of physicians and apothecaries must have led to great inefficiency in treating the sick; and the private soldiers must have suffered unnecessary hardships and come to untimely deaths from the lack of a proper establishment of physicians and apothecaries.

To end this paper I have included a list of all the medical officers of this period that I have been able to collect. Many of these are little more than names, and it may be thought hardly worth while to mention them. But they were, in their day and generation, the representatives of a Corps in which all readers of this journal must be interested; and surely it is but just that we should try to keep their memory green. "These were men of mercy, whose righteous deeds have not been forgotten."

ATKINSON.—In 1594 appointed physician for the State in Ireland at a salary of £40 per annum. After his death, he was succeeded by Dr. Turner (C.S.P., I., 1600-1, p. 242).

BLISSE, HUMFRYE.—The muster roll of Sir Edward Denny's company in Ireland contains the name of Humfrye Blisse as the surgeon of the company (C.S.P., I., 1588-92, p. 152).

BROWNYNG, HENRY.—Appointed as a surgeon in the army on May 16, 1514 (L.P., H. VIII, p. 804).

CHRISTIAN.—On August 20, 1582, was the surgeon of Captain William's Company of Light Horse (C.S.P., F., 1582, p. 250).

CLOWES, WILLIAM.—This famous English surgeon served at Newhaven under the Earl of Warwick in 1563. In 1570 he was acting as a naval surgeon in Her Majesty's Ship "Aid." In 1586 he and Godorus were the two principal surgeons to the Army under the Earl of Leicester in the Low Countries. In this campaign he was at Arnheim during the siege of Nimenguen ("A Profitable and Necessarie Booke," pp. 59, 111, 122 and Norman Moore "History of St. Bartholomew's," vol. ii).

COLFF.—An apothecary in Cornwall. The Earl of Warwick, the Governor of Havre, on July 2, 1563, requested that he should be sent over to that garrison, as he had experience in dealing with the type of disease that was raging there. The Earl asks that Colff may be given an advance of £100 to equip himself for this service (C.S.P., F., 1563, p. 438).

CUMBERLAND, JOHN.—On December 12 was pressed by the governors of the Barber Surgeons Company for service with the Army in Ireland (Young, p. 321).

DERYCK was surgeon to Sir Robert Sydney in the Low Countries. He was murdered at Landricht on October 15, 1601, by another surgeon named Giles (De Lisle, p. 539).

FERQUAR, WILLIAM, is shown in the muster roll of Sir Thomas Norrey's company as holding combined offices of "pheife and Surgeon" (C.S.P., I., 1588-92, p. 153).

FULLER, GABRIEL.—Receive an imprest of 40s to serve in the Army overseas. On June 4, 1512, he is described as being a prisoner in the lock-up (counter) in Bread Street, and

- Captain James Dornell is given an order of release to get Fuller out of gaol, so that he can go on service (L.P., H. VIII, i, p. 361).
- GALE, THOMAS.—This distinguished surgeon served at Montreuil in 1544. He was present at the siege of St. Quentin in 1557. He was the author of a "Treatise of Gonneshotte," which was the first English textbook on the subject (Treatise of Gonneshot, p. 16).
- GODORUS, —Was serjeant surgeon to Queen Elizabeth. He and Clowes were the principal surgeons to the Army in the Low Countries in 1586 (Clowes, p. 111).
- INCHE (or INSE), RICHARD.—On December 29, 1594, was surgeon to Sir Henry Bagenall's company. Had been in the service for thirty years (C.S.P., I., 1592-6, p. 289).
- JOHNSON, JOHN.—Was surgeon to the Household Troops at the Camp before Boulôgne at the end of July, 1544. His pay, was 1s. per diem (L.P., H. VIII, xxix. pt. 1, p. 607).
- JULIO.—Was physician to the garrison at Havre. He was sick at the end of June, 1563, and had to leave the town during the following month, on account of his health (C.S.P., F., 1563, pp. 430 and 438).
- KELLYE, THOMAS.—In 1567 was under surgeon on the Irish Establishment at 1s. a day (De Lisle, i, p. 395).
- KELLYE, WILLIAM.—In May, 1567, was senior surgeon on the Irish establishment at 2s. a day. He held this position till his death in 1597, and is referred to as the surgeon general. For a period in 1582, he appears to have been out of employment, but regained his position some time in the same year. In 1584 he was on active service in the north of Ireland. He was succeeded by Walter Newton (H.M.C., De L'Isle and Dudley Papers, i, p. 395, xi, p. 234; C.S.P., I., 1574-84, pp. 368, 536, 1600-1, p. 242).
- LOMELINE, DOMINICK, was pressed for service in Ireland by the Barber Surgeons Company on December 12, 1598, but managed to get his discharge by bribery. He was Master of the Barber Surgeons in 1629 (Young, p. 321).
- MASTER, —Appointed by the King to be physician at Boulogne. He had been physician to the Duke of Suffolk (A.P.C., 1542-7, p. 544).
- MEDICUS,—A Spaniard. He was senior surgeon to the train of Lord Lisle at Southampton at 2s. a day (L.P., H. VIII, i, pp. 721-2).
- MUFFETT, J.—Physician to the Earl of Essex, he arrived at Dieppe in the "Tremontana" on October 29, 1591 (Salisbury, iv, p. 154).
- NEWTON, WALTER, succeeded William Kelly as surgeon general in Ireland in 1597 (C.S.P., I., 1600-1, p. 242).
- PICKERING, WILLIAM.—A surgeon of St. Bartholomew's Hospital. On February 25, 1597, was appointed surgeon to the Lord Deputy of Ireland (A.P.C., pp. 521-2).
- ROGERS, LEWIS, was a surgeon to the Army in Ireland in 1602 (C.S.P., I., 1601-2, p. 401).
- ROWLAND, NICHOLAS, was surgeon to the garrison at Rynrone and Ryncorren in Ireland (C.S.P., I., 1601-3, p. 369).
- SMITH, THOMAS, was apothecary to the Army in Ireland for a large number of years. In 1584 he is described as having been in practice in Dublin for nearly twenty-six years (C.S.P., I., 1509-77, p. 299, 1574-85, pp. 498, 501).
- TURNER,—Succeeded Atkinson as physician for the State in Ireland at £40 per annum. He died before March 27, 1601, when his appointment was given to the Master and members of Trinity College (C.S.P., I., 1600-1, p. 242).
- YAN, JOHN, was a barber surgeon of Molsham near Chelmsford. On April 26, 1513, was engaged to serve in the Army overseas under Lord Bergevenny (L.P., H. VIII, i, pp. 721-2).

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Barrett.	C. R. B. Barrett, "The History of the Society of Apothecaries of London."
Clowes.	William Clowes, "A Profitable and Necessarie Booke."
C.C.P.	Calendar of Carew Papers.
Cruickshank.	C. G. Cruickshank, "Elizabeth's Army."
C.S.P., F.	Calendar of State Papers, Foreign.
C.S.P., I.	Calendar of State Papers, Irish.

- De Lisle. De Lisle and Dudley Papers. Historical Manuscripts Commission.
Devon. Frederick Devon, "Pell Records."
Foljambe. Foljambe Papers. Historical Manuscripts Commission.
Gale (a) Thomas Gale, "Office of a Chirurgion."
Gale (b) Charles Gale, "Certaine Workes of Chirurgerie."
Goodall. Charles Goodall, "The Royal College of Physicians of London."
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Clinical and Other Notes.

AUXILIARY NURSING SERVICE (India).

THE outbreak of the war found India totally unprepared in the nursing field to meet any emergency which might be required of her. By the end of 1940 it became evident that the existing arrangements for increasing the number of certificated nursing personnel to meet the needs of the Army were wholly inadequate and would break down.

It was under these circumstances the Auxiliary Nursing Service was constituted as an emergency service during 1941. In the early days the scheme aimed at producing a large number of partially trained nurses, within the shortest possible time, capable of rendering assistance in the nursing of sick and wounded in military hospitals under the supervision of nursing officers. In those days the urgent need was for quantity and efforts were concentrated upon obtaining numbers of women from all classes with the minimum standard of education acceptable to the Provincial Nursing Councils.

When the initial target of 1,000 had been reached by the middle of 1942, the desirability of concentrating on quality (as against quantity) was carefully examined and revised rules were issued raising the educational standard to matriculation or equivalent and the trainees had to reside in the training institutions or approved hostels attached. This was an essential measure consequent on the decision of the Provincial Nursing Councils to recognize the initial training towards the period required to complete the full training should the candidate desire to continue nursing.

The original terms of service provided for only one year's contract with option to resign from the service or renew the contract for further periods of one year at a time. It was felt at the time to ask the members to sign for the duration of the war might act as a deterrent to obtain numbers; but in April, 1942, the W.A.C. (I.) was formed and by the end of October, 1942, many auxiliaries resigned and joined this service which offered more attractive terms and less arduous duties. While this could not be prevented it was agreed that steps should be taken to prevent this drift and the A.N.S. rules were amended to provide for service for the duration of the war and six months thereafter.

As time went on, regulations and salaries were altered and improved.

In order to assist as far as possible all those auxiliaries who desired to complete their training, arrangements were made to staff a few hospitals to function as affiliated training centres. For a considerable period the teaching staff on these hospitals included qualified Sister Tutors—members of the Q.A.I.M.N.S. who before the war acted in this capacity on the staff of Civil Nurse Training Schools in the United Kingdom. Thus a large number of auxiliaries were able to take this further training and sit for the preliminary State examination of

the provincial nursing councils while they were serving. Many of the auxiliaries who passed the examination have been released from the Service to finish their training in civil hospitals with a view to qualifying as fully trained State-registered nurses.

The concessions admissible to members of the A.N.S. approved by all the Provincial Nursing Councils are generous and directed towards encouraging the members to take up nursing as a career.

In all, some 3,300 women of India, Britain and Burma, and even from Canada and Hong Kong, joined and gave their whole-hearted and devoted service to the Armies of India.

A large number of members of the A.N.S. have at some time or other served overseas in Middle East, Iraq and Iran, Italy, the U.K., Burma, Malaya, N.E.I. and on hospital ships. Five members proceeded to the U.K. in 1946 to participate in the Victory Celebrations on June 8.

A number of members have been mentioned in Despatches, three members have received the Honour of Associate Members of the Royal Red Cross.

199 Nursing Cadets were allotted vacancies for training in civic hospitals and of these 111 have so far been released to take general nursing training.

Members of the A.N.S. have rendered invaluable service to the Armed Forces, many of them accepting and efficiently carrying responsibilities equal to those usually undertaken by certificated nursing officers as and when occasion demanded due to lack of staff.

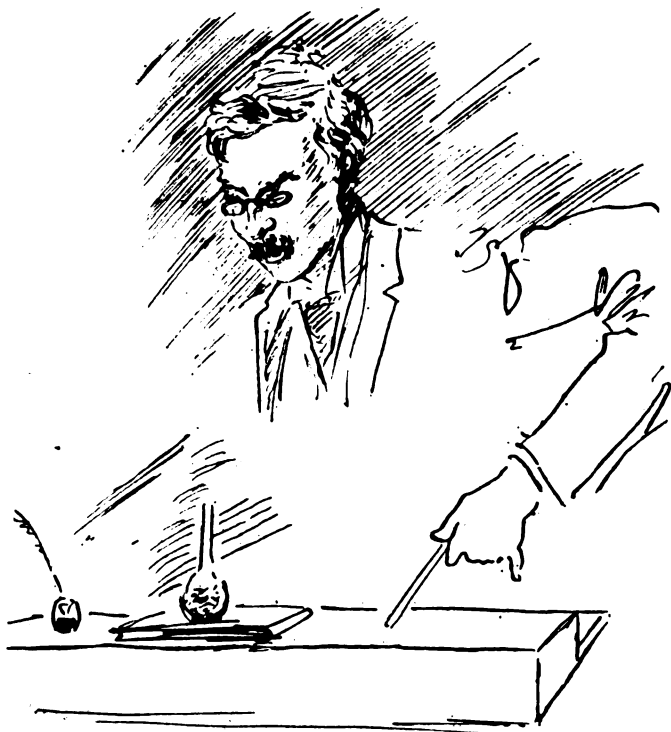
To those who were responsible for the treatment of sick and wounded in the cramped hospitals and on the congested lines of communication of 1942-1944 the advent of the A.N.S. was a godsend; to those whom they helped to nurse, often in the most adverse conditions of mud and rain, jungle and desert heat, primitive accommodation and make-do equipment, the care and devotion of these A.N.S. girls will ever remain a thankful and grateful memory.

The Nursing Services of the British and Indian Armies, working in fighting areas where the "Medical Victory" was one predominant factor in final Victory, did a grand job throughout the hard years and the A.N.S. nobly took their share.

Editorial.**IN MEMORIAM.****SIR ALMROTH WRIGHT.**

By the death of Sir Almroth Wright at his home in Buckinghamshire on April 30, 1947, not only the Empire but the civilized world lost a man who, by his epic work in the science of Immunology, brought help of inestimable value to workers in the field of preventive medicine and saved the lives of many thousands.

The scale of his activities was wide and varied comprising studies on Typhoid, Anthrax, Tuberculosis, Pneumonia, Plague, Cholera, on Microscopy, Hæmorrhage, etc. The list of his scientific publications is legion. His "Technique of the Teat and Capillary Glass Tube" (written with the collaboration of Colebrook) is known to all laboratory workers, and there can be few medical officers who are not familiar with a Wright's capsule.



S. Lyle Cummins

An original pen-and-ink sketch by S. Lyle Cummins who, at the time, was one of Almroth Wright's students in the Army Medical School at Netley.

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He had a long and close connexion with the Medical Services of the Army. On his return to this country in 1892 from Sydney at the age of 31 he took up the appointment of Professor of Pathology at the Army Medical School, Netley (the forerunner of the Royal Army Medical College, Millbank). Sir Almroth was the first to fill this appointment which he occupied till 1902. It was during this period 1892-1902 whilst Professor at Netley and whilst giving instruction to so many surgeons-on-probation in the Army Medical Service and Indian Medical Service, that he originated his epoch-making work on antityphoid vaccine.

Prior to his appointment at Netley, Sir Almroth had worked in the Medical Research Laboratories of the Royal College of Physicians and Surgeons, and had been Demonstrator of Pathology in the University of Cambridge. In the University of Sydney he filled the post of Professor of Physiology (1889-1892), one result of which was that in his new post at Netley he introduced into his lectures much stimulating physiological research work in addition to instruction in Tropical Diseases and Pathology. This work was new to most of the class and was one of the factors which made his lectures according to one of his pupils "by far the most interesting and popular of the course." At that time he was working on the coagulability of the blood, and he made all members of the class estimate their own coagulation time by his method of taking samples at intervals of half a minute or so to see how long they remained unclotted.

In 1892, Sir Almroth's first year at Netley, Haffkine visited the Army Medical School to demonstrate his method of inoculation against cholera by the injection of live cultures of the causative vibrio; the method of preparing the vaccine was later demonstrated to his class by Sir Almroth. This visit of Haffkine's must have played a large part in suggesting to Wright the practical possibilities of antityphoid immunization, as it was at this time that he started his intensive work on the dosage, strength and testing of antityphoid vaccines which led to his elucidation of the all-important fact that killed typhoid bacteria were active immunizing agents.

It was in the *British Medical Journal* of January 30, 1897, that he published, in collaboration with Surgeon Major Semple, Assistant Professor of Pathology at Netley, his article on vaccination against typhoid fever, and it was during the winter of 1897 to 1898 that he succeeded through the then D.M.S. India—Surgeon General Cleghorn—in obtaining a trial of his vaccine on British Army volunteers in India. Incidentally, at this time also, Sir Almroth invited the A.M.S. and I.M.S. officers who were first in the class to have the privilege of being inoculated in order to ascertain the correct dose. Both officers consented and were duly inoculated, and both had, what is described by one of the subjects, as a "bad reaction," being laid up for twenty-four hours and two days respectively, but they loyally assured Sir Almroth that they were "doing well."

His work on antityphoid vaccine was viewed askance by his contemporaries at the time and, it must be admitted, by other members of the staff who considered this experimentation on surgeons on probation as rather terrible and, according to one of the two subjected to trial, were rather hopeful that the two

subjects might demonstrate Wright's "wrongdoing" by being very ill indeed; fortunately, this was not the case.

Leishman was attached to Wright's laboratory on his return from India in 1897 and by degrees became more and more engrossed in the work going on at the time, including that on the new typhoid vaccine, but it was not until 1900 that Wright published in collaboration with him an article in the *British Medical Journal* on the results obtained and methods employed in making the vaccine.

Wright was essentially a practical man and much of his work and many of his scientific publications were concerned with methods and techniques, e.g. on the technique of serum diagnosis and on the estimation of the bactericidal power of the blood, etc. He believed in the words of Pasteur, which he quoted in the preface to one of his works "Come away from these polemical discussions . . . come and be taught methods," and no one was better qualified to do so that he was.

Sir Almroth's departure from the Army Medical School in 1902 to his appointment as Pathologist to St. Mary's Hospital, where he founded what was later to become the Institute of Pathology and Research, did not mean the complete severance of his connexion with the Army Medical Service, as he was a Consultant Physician to the British Forces during the First World War and a valued member of the committee on antityphoid vaccine up to 1938.

The mass of statistical evidence which has accumulated in support of his work on antityphoid vaccine is so great and incontrovertible that repetition may seem redundant, but the comparative figures for the South African and First World War are of continued interest and are given once more.

RESULTS OF ANTITYPHOID INOCULATION.

SOUTH AFRICAN WAR			FIRST WORLD WAR		
<i>Before introduction of inoculation</i>			<i>After introduction of inoculation</i>		
Average strength of Force 1899-1902	No. of cases of enteric fever	No. of deaths from enteric fever	Average strength of Force 1914-18	No. of cases of enteric fever	No. of deaths from enteric fever
208,266	57,684	8,022	1,235,644	7,423	266

If antityphoid inoculation had not been introduced, it is doubtful whether, in two world wars, it would have been possible to maintain enormous and closely concentrated armies in the field without a disastrous epidemic.

In paying our major tribute to the work on antityphoid immunization it is not that we forget Sir Almroth Wright's activities in other fields but that this work was of paramount importance to the Services, that it originated during his time at Netley, and has been a continuing inspiration since that time.

But Wright did more for the Army. Who can doubt that the impact of his personality on the young men embarking on a Service career did much to determine the course of many of them in scientific medicine? Amongst those who came under his influence at Netley between 1892 and 1902 were Harrison, Lyle Cummings, Birt, Leonard Rogers, Seiple, Leishman, Firth and many others.

And now we say farewell to one who laid the foundation of the teaching and practice of pathology in the Army well and truly so that there was raised a Service whose performance in two great wars has been of incalculable benefit.

Notices.

LEISHMAN, ALEXANDER AND PARKES MEMORIAL PRIZE FUND.

It is announced that the following prizes are available for award in 1948. Conditions of award are as stated.

PRIZE	OPEN TO	REMARKS
The Leishman Memorial Prize (silver-gilt medal and approximately £30)	Officers R.A.M.C. or Officer removed from the Corps but still on the Active List. Officers R.A.D. Corps. (Officers must be serving on Regular or Short Service Commissions.)	Awarded for the best work in any branch of Medicine, Surgery or the allied sciences, or in connexion with the general duties of the R.A.M.C. or R.A.D. Corps. brought to the notice of the R.A.M.C. Prize Funds Committee during the year, but not necessarily completed within the year.
The Alexander Memorial Prize (silver-gilt medal and approximately £70)	R.A.M.C. Officers as above.	Awarded to the Officer who by professional work of outstanding merit has done most to promote the study and improvement of Military Medicine, Military Surgery, Military Hygiene or Military Pathology during the year. First consideration will be given to original articles or reports of investigations of value from the point of view of Military Medicine, Surgery, Hygiene or Pathology, and published in one or other of the various Medical Journals. Part authorship of an article is not admissible.
The Parkes Memorial Prize (silver-gilt medal and approximately £60)	Regular serving Medical Officers on full pay of the Royal Navy, Army or the Indian Army.	Awarded for professional work of outstanding merit which has done most to promote the study of Naval or Military Hygiene. First consideration will be given to articles or reports of investigations of value from the point of view of Naval or Military Hygiene published in one or other of the various Medical Journals. Part authorship of an article is not admissible.

NOTE.—The Alexander Memorial Prize and the Parkes Memorial Prize are not open to officers on the staffs of the Royal Naval Medical School, the Royal Army Medical College or the Army School of Hygiene.

Recommendations should be sent in through the usual channels with copies of original articles or reports of investigations, to reach the Hon. Secretary,

R.A.M.C. Prize Funds Committee, R.A.M. College, Millbank, London, S.W.1.
by December 31, 1947.

The following prizes have been awarded for the year 1946:—

Parkes Medal and £60	Major-General F. Harris, <i>C.B.E., M.C., M.B. Late</i> R.A.M.C.	For distinguished work in Hygiene in India and the Far East.
Leishman Medal and £30	Lt.-Colonel A. D. Young, <i>D.S.O., M.B., R.A.M.C.</i>	For a paper on "The Para- chute Field Ambulance."
Alexander Medal and £70	Lt.-Colonel W. H. Har- greaves, <i>M.R.C.P., R.A.M.C.</i>	For his published work on Amœbiasis.

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OF THE

Royal Army Medical Corps

EDITED BY

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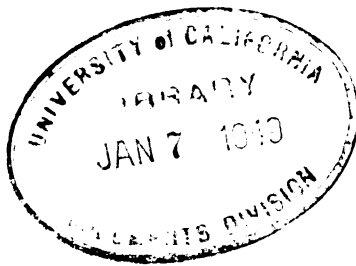
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July, 1947.

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Medical Corps

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EDITOR

COLONEL G. W. WILL, *O.B.E.*

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**MENINGOCOCCAL INFECTIONS IN THE ARMY,
1939-1945**

With 30 Selected Illustrative Cases

BY

Major-General R. PRIEST, C.B., M.A., M.D., F.R.C.P.

Late Consulting Physician B.E.F. (France) and Western Command (U.K.).

INTRODUCTION.

It was indeed fortunate that the initial force of the wave of cerebrospinal meningitis and meningococcal infections arrived during the early stages of the war, occurring as it did during that heaven-sent period of nine months' operational inactivity which characterized the period from September, 1939, to May, 1940. This period of inactivity proved valuable in several ways: First, it enabled the hospital beds at home and with the B.E.F. (France) to be prepared without the simultaneous influx of wounded; secondly, it gave time to adjust our ideas as to the best use of sulphonamides, particularly as to dosage and as to the particular preparation to use. This period also saw the introduction of the soluble preparations to be given intravenously or intramuscularly, thus saving the lives of many patients suffering from the acute fulminating forms. So it was that by the time the maximum incidence was being reached in France, we were no longer dependent upon the hospital accommodation of our Allies, but could receive all that were sent for admission to our own medical units. Further, owing to the lack of wounded and maimed, there was at no time pressure on our hospital beds at Home and, as far as the hospital accommodation in France was concerned, any undue pressure that may have occurred was relieved by unhampered evacuation to bases or, if necessary, to England without embarrassment from the air or sea.

Another important beneficial effect of this initial period of anxious waiting was that in addition to the Instructions already issued by the Army Medical Directorate B.E.F., it gave time for the War Office and the Ministry of Health to prepare and send out Instructions and Memoranda at suitable intervals, in which were included the general symptomatology and the latest method of

treating these infections and the recent decisions regarding the isolation of contacts and the taking of throat swabs.

The Instructions, Memoranda from the A.M.D. and Ministry of Health, and also the lectures which were given to medical officers of the B.E.F. doing duty in forward areas, served the dual purpose of not only keeping medical officers up to date but also of keeping them alive to the protean forms of onset of this type of meningitis. During the time the evacuation from Europe in June, 1940, was being completed, the incidence of this disease had fallen to negligible proportions and never again during the whole of the war period did cerebrospinal meningitis prove to be a serious cause of mortality or loss of man-power in any region where our troops were engaged.

GENERAL CONSIDERATIONS.

There is now general acceptance that the *Neisseria meningitidis vel Neisseria intra cellularis*, popularly termed the meningococcus, having once gained access to the nasopharynx may remain there dormant, causing no symptoms, in which case the individual becomes an unwitting "carrier".

From the nasopharynx the organism may sooner or later invade the blood-stream and may then cause, at one extreme, an acute fulminating septicæmic condition with or without the involvement of the meninges or of the brain substance itself, or, at the other extreme, a low-grade bacteraemia associated with a variety of symptoms and physical signs lasting over a very variable period of time, the condition referred to by some as a meningococcaemia. Or again the *Neisseria* may rapidly attack the meninges with great force to cause a severe form of meningitis or perhaps a meningo-encephalomyelitis; more usually, however, the invasion is moderate in quality and produces what might well be termed the ordinary, well-known, easily recognized form of cerebrospinal meningitis. It can be easily imagined therefore that according to the structures or organs of the body attacked either singly or in combination by this organism, many clinical forms can be produced, some very puzzling and difficult of diagnosis. These will be referred to in more detail later.

The advent of the sulphonamide drugs—first in the form of sulphanilamide and afterwards by sulphapyridine and later still by a series of similar compounds, sulphathiazole, sulphadiazine, sulphamethazine—has altered our attitude to meningococcal infections in general and towards the cerebrospinal form in particular. Previous to their use the latter had been regarded, with all good reason, as a dire disease, highly infectious, requiring immediate and complete isolation and, by its high mortality, had created a fear and dread among the population almost equal to that of the plague in London in the time of Samuel Pepys. The introduction of these compounds and the rapidity of their absorption have rendered it possible to produce and maintain a sufficiently high concentration in the blood and cerebrospinal fluid to bring the growth and toxic activity of the *Neisseria* in the tissues to an end within the space of a few hours. Moreover, after the usual dosage the organism in the nasopharyngeal discharges has in the large proportion of cases become inert and innocuous, so that by taking a few initial precautions such as the wearing

of masks by the nursing staff and by placing the patient behind screens, it has become possible to nurse patients in general wards with reasonable safety. This indeed has been on many an occasion a great boon in those instances where either the patient has been too ill to be moved or where isolation accommodation has been impossible.

These compounds, too, have reduced the complications, sequelæ and residua, both organic and functional, to remarkably small proportions. Especially has this been observed amongst personnel of the Army age-group.

One of the greatest blessings bestowed upon medical officers in wartime has been the enablement to dispense entirely with the therapeutic use of anti-meningococcal serum, necessitating as it did innumerable thecal punctures. Nowadays, one single puncture for diagnostic purposes is the rule, subsequent punctures being only necessary for the relief of pressure. The abandonment of the use of the specific serum has also made the task of grouping the meningococcus isolated from tissue fluids more a matter of academic interest than an essential. It should not be forgotten that the antimeningococcal serum is not inexpensive to prepare and that carriage and storage space of the large quantity required for an Army in the field bulk largely in the administrative problems of a Field Medical Store.

In conclusion, as a result of sulphonamides, the mortality of meningococcal infections has been reduced and this reduction will be seen best in the Service age-group because they report sick early and soon find themselves admitted to medical units whose medical officers have been, by means of consultants' visits, by official instructions and memoranda issued to all medical officers from time to time, kept "aware" of the likelihood that an infection may be meningococcal with the consequence that, with few exceptions, the disease has been recognized early and the administration of sulphonamides in adequate dosage has been commenced immediately.

This was well exemplified during the outbreak of cerebrospinal fever among the troops in the B.E.F. (France) in 1939-40. During the early period, when our own units were not ready, cerebrospinal fever patients were admitted to Allied hospitals in most of which they were treated by repeated lumbar punctures and injections of specific serum and not by chemotherapy. As soon as our own medical units were ready to receive them, they received immediate treatment by sulphapyridine with a consequent remarkable fall in the mortality rate, thus:—

Death rate for the first 98 cases was 16.3 per cent.

Death rate for the next 92 cases was 3.3 per cent.

Death rate for the next 31 cases was 3.2 per cent;

and for the total of 221 cases the death-rate was 9 per cent (Priest, 1941).

During the last period of the war patients were treated with penicillin and sulphonamides and later still by penicillin alone. American writers (Rosenberg and Arling, 1944) claim equally good results with penicillin alone as with sulphonamides, but in spite of this, the disadvantages of the necessary intra-

thecal injections every twenty-four hours combined with intravenous drip and intramuscular administrations cannot be overlooked.

INCIDENCE.

Under the existing system of documentation it is impossible in any Command at Home to obtain information regarding the incidence of cases of any particular disease. Patients are admitted to Military, E.M.S. and Civilian Isolation Hospitals and such admissions are not notified to the D.D.M.S. of a Command. Therefore, no computation of incidence and mortality can be made until the Army Record Cards (A.F.I.1220) and the clinical records made by E.M.S. and isolation hospitals have been collected and analysed. In some areas overseas figures of incidence should be more easily obtained because all patients would pass through our own Army medical units. In other areas, however, the incidence reports would be vitiated because some of our patients have been admitted to medical units of our Allies. The figures which have been supplied to me must be regarded as entirely provisional and cannot be accepted as in any way accurate at this stage.

INCIDENCE OF CEREBROSPINAL MENINGITIS (BRITISH MILITARY PERSONNEL).

	U.K.		M.E.		C.M.F.		B.A.O.R.	
	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000
1939								
(Sept.-Dec.)	54	0.23						
1940	1,516	1.46						
1941	938	0.49						
1942	460	0.23	50	0.15				
1943	238	0.16	49	0.13	40	0.10		
1944	183	0.11	25	0.12	19	0.04		
1945	237	0.23			22	0.06	40	0.07
	(to Nov.)				(to Oct.)		(Feb.-Oct.)	

(1) In addition we have returns from ALFSEA covering six months in 1945 during which only one British Army case was reported.

(2) Owing to imperfect documentation the above figures, and especially those relating to U.K., may be somewhat defective.

Deaths.—With regard to deaths from cerebrospinal fever there is very little information available. What is available, mainly for M.E. suggests that the fatality rate is of the order of 1 : 10.

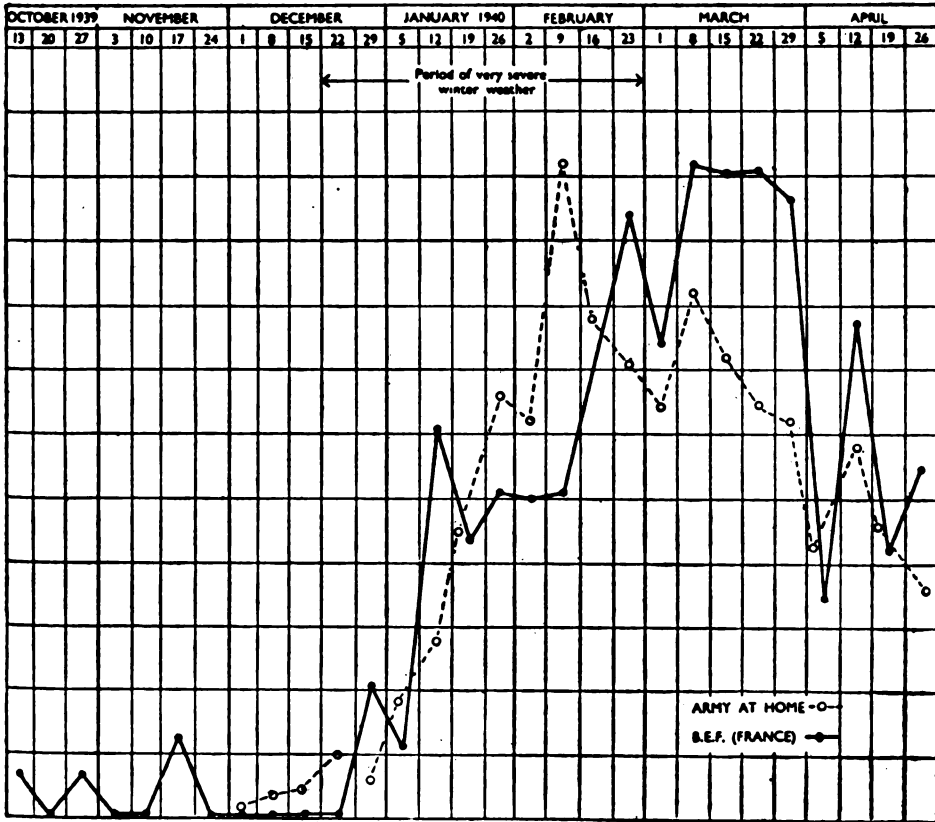
Deaths recorded were as follows:—

				Deaths	Total cases
M.E.	...	...	1942	4	50
	...	...	1943	6	49
	...	...	1944	6	25
C.M.F.	...	...	1945	1	8
			(July-Oct.)		
B.A.O.R.	...	...	1945	5*	40
			(Feb.-Nov.)		

*These are called "meningitis."

The incidence among troops in the B.E.F. (France) was compiled from figures obtained direct from the Medical Directorate at Army Headquarters. The chart shows the curve of weekly incidence of the disease in ratios per 1,000 from October 13, 1939, to April 26, 1940, amongst the troops in France compared with the Army at Home. For security reasons the actual numbers had to be omitted. As expected, the curve is similar to and almost parallel to that for the general population in the United Kingdom.

TABLE I



No age was exempt and in France the oldest patient was 45 and the youngest 18.

ONSET.

It has already been mentioned how varied and deceptive the symptoms and physical signs may be in the very early stages of cerebrospinal fever and this was confirmed by a review of the diagnoses made by medical officers who saw the patients at an early stage of their illness. There were 73 "early diagnoses" collected from the field medical cards and these included cerebral conditions: meningitis 8, cerebrospinal meningitis 6, severe headache 4, meningismus 2, cerebral irritation 2, mental confusion 2, meningeal signs 1, mental irritability 1, injury to head 1, N.Y.D., hysteria 1, neurasthenia 1, subarachnoid hæmor-

treating these infections and the recent decisions regarding the isolation of contacts and the taking of throat swabs.

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thecal injections every twenty-four hours combined with intravenous drip and intramuscular administrations cannot be overlooked.

INCIDENCE.

Under the existing system of documentation it is impossible in any Command at Home to obtain information regarding the incidence of cases of any particular disease. Patients are admitted to Military, E.M.S. and Civilian Isolation Hospitals and such admissions are not notified to the D.D.M.S. of a Command. Therefore, no computation of incidence and mortality can be made until the Army Record Cards (A.F.I.1220) and the clinical records made by E.M.S. and isolation hospitals have been collected and analysed. In some areas overseas figures of incidence should be more easily obtained because all patients would pass through our own Army medical units. In other areas, however, the incidence reports would be vitiated because some of our patients have been admitted to medical units of our Allies. The figures which have been supplied to me must be regarded as entirely provisional and cannot be accepted as in any way accurate at this stage.

INCIDENCE OF CEREBROSPINAL MENINGITIS (BRITISH MILITARY PERSONNEL).

	U.K.		M.E.		C.M.F.		B.A.O.R.	
	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000	Cases reported	E.A.R. p. 1000
1939								
(Sept.-Dec.)	54	0.23						
1940	1,516	1.46						
1941	938	0.49						
1942	460	0.23	50	0.15				
1943	238	0.16	49	0.13	40	0.10		
1944	183	0.11	25	0.12	19	0.04		
1945	237	0.23			22	0.06	40	0.07
	(to Nov.)				(to Oct.)		(Feb.-Oct.)	

(1) In addition we have returns from ALFSEA covering six months in 1945 during which only one British Army case was reported.

(2) Owing to imperfect documentation the above figures, and especially those relating to U.K., may be somewhat defective.

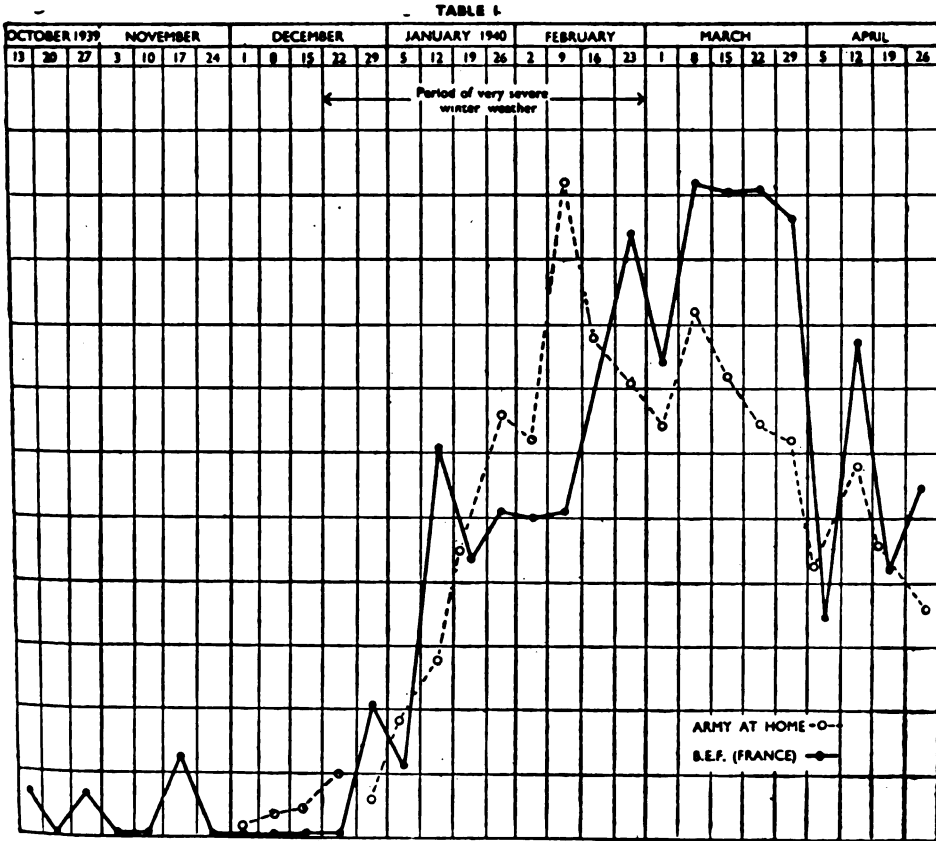
Deaths.—With regard to deaths from cerebrospinal fever there is very little information available. What is available, mainly for M.E. suggests that the fatality rate is of the order of 1 : 10.

Deaths recorded were as follows:—

				<i>Deaths</i>	<i>Total cases</i>
M.E.	...	...	1942	4	50
	...	...	1943	6	49
	...	...	1944	6	25
C.M.F.	...	...	1945	1	8
			(July-Oct.)		
B.A.O.R.	...	...	1945	5*	40
			(Feb.-Nov.)		

*These are called "meningitis."

The incidence among troops in the B.E.F. (France) was compiled from figures obtained direct from the Medical Directorate at Army Headquarters. The chart shows the curve of weekly incidence of the disease in ratios per 1,000 from October 13, 1939, to April 26, 1940, amongst the troops in France compared with the Army at Home. For security reasons the actual numbers had to be omitted. As expected, the curve is similar to and almost parallel to that for the general population in the United Kingdom.



No age was exempt and in France the oldest patient was 45 and the youngest 18.

ONSET.

It has already been mentioned how varied and deceptive the symptoms and physical signs may be in the very early stages of cerebrospinal fever and this was confirmed by a review of the diagnoses made by medical officers who saw the patients at an early stage of their illness. There were 73 "early diagnoses" collected from the field medical cards and these included cerebral conditions: meningitis 8, cerebrospinal meningitis 6, severe headache 4, meningismus 2, cerebral irritation 2, mental confusion 2, meningeal signs 1, mental irritability 1, injury to head 1, N.Y.D., hysteria 1, neurasthenia 1, subarachnoid hæmor-

rhage 1. Total 30, i.e. 41.1 per cent referable to some intracranial or cerebral abnormality. Influenza 13, acute gastritis 4, gastric influenza 1, enteritis 1, acute appendicitis 1, malaria 1, enteric fever 1, pyrexia of uncertain origin 4, acute rheumatism 2, muscular rheumatism 2, general pains 2, renal colic 1, subacute nephritis 1, bronchopneumonia 1, bronchitis 1, sore throat 1, pharyngitis 1, erythema nodosum 1, dermatitis 1, epistaxis 1, acidosis 1.

Broadly speaking, cerebrospinal fever appeared in the B.E.F. in France in the following forms:—

Severe fulminating type with rapid loss of consciousness; and in which the meningeal signs occurred rather late. These patients appeared cyanosed, toxæmic and, if vomiting had been excessive, dehydrated; if the real nature of condition was not appreciated and the administration of sulphapyridine was delayed, a fatal termination was more than probable.

MODE OF SPREAD.

All observers are agreed that the meningococcus is present in the droplets and discharges from the nasopharynx, including the tonsils and sinuses and that infection is conveyed from individual to individual by these droplets. Presumably, too, infection may be conveyed by means of saliva on unclean cups and mugs. From the literature it would appear that not one but many factors operate in spreading the disease. Of these, overcrowding has been prominent. Fairbrother (1940) thinks too much stress has been laid on overcrowding as a cause and considers over-exertion, fatigue, the resistance of the individual and the virulence of the organism are more potent causes.

Overcrowding in barrack rooms does not seem to be an important cause of spread for it is very seldom discovered that more than one case arises in one particular room or hut (Fairbrother, 1940). In the B.E.F. only one instance occurred amongst a collected series of 204 cases (Priest, 1941). The congregation of members of many different units in canteens, entertainment halls and dance rooms where there is active movement, talking, coughing, laughing and sneezing must surely be a more potent source of infected droplets than in a barrack room where during the greater part of the dark hours, the majority of occupants are resting or sleeping. Further, infection gained at massed meetings of mixed units would render the disease sporadic in type, which in fact it proved itself to be.

The infection is usually spread by carriers of whom some may not complain of any symptoms while others have had recent catarrhal symptoms with tonsillitis (van Rooyen and Morris, 1941). A high carrier rate, it was stated, precedes an outbreak of the disease (Gordon, 1919) but it has since been shown that a carrier rate of 50 per cent can exist for many months without cerebrospinal meningitis developing (Dudley and Brennan, 1934). That cerebrospinal fever becomes more prevalent during wars has been well shown by the outbreak in World War I during 1915-16, again in World War II during 1939-40-41.

In America, too, cerebrospinal meningitis began to assume large proportions in 1943 soon after the mobilization of the nation for war. The answer to this complex question seems to be primarily in the combination of mass

movement and displacement of individuals requisite to the formation and training of Service units, the organization of industry, the evacuation of young and old from the towns to safer areas and the unavoidable mingling of non-immunes with immunes. Then follow over-exertion, fatigue, overcrowding, inadequate ventilation, adverse climatic conditions leading to colds, sore throats and other upper respiratory catarrhs which all play their parts either singly or together, according to the degree of susceptibility of the individual and the virulence of the organism, in producing the evident disease.

With regard to prophylaxis, it is well known that during the outbreak in 1915-16 nasopharyngeal swabbing to detect carriers was carried out on a prodigious scale and the unfortunate carriers were subjected to nasopharyngeal sprays, douches, inhalation of steam impregnated with chemicals such as zinc chloride. Early in this last war, 1939-45, routine swabbing of the nasopharynx remained in force until the publication in February, 1940, of a War Office memorandum advising medical officers that wholesale nasopharyngeal swabbings served no useful purpose. Later in the same year, October, 1940, a further memorandum was published by the War Office giving advice regarding the treatment of carriers by sulphanilamide. The situation, however, regarding carriers, swabbing of contacts, isolation of contacts and treatment of anyone discovered harbouring the *N. meningitidis*, became so confused that the Director-General Army Medical Services invited certain distinguished civilian members of the Profession to a meeting of Army Consultants on December 10, 1941. At this meeting it was agreed first that a "contact" should be defined as one who is a close personal associate of a case of cerebrospinal fever; secondly, contacts need not be isolated; thirdly, sulphonamides should not be administered prophylactically and, fourthly, carrier rates should not be estimated except for special investigations. These conclusions were embodied in a very comprehensive War Office Memorandum on June 30, 1942.

American workers have reported great success, however, in the mass prophylaxis of meningococcal infections by the administration of sulphadiazine in the remarkably small dosage of 2 grammes daily for two days (Kuhns, Nelson, Feldman and Kuhn, 1943). In another experiment (Cheever, 1945) 600,000 men were given 0.5 to 1 gramme of the same drug daily during their seven weeks' training. The author concluded that 1 gramme of sulphadiazine succeeded almost completely in eradicating morbidity from meningococcal meningitis. Phair and Schoenbach (1945) found that a total dose of 2 grammes of sulphadiazine sufficed to eliminate the *N. meningitidis* from the nasopharynx, but they also state that sulphonamides cannot control the incidence of infection indefinitely.

In the British Army no mass prophylactic measures by means of sulphonamides to prevent upper respiratory diseases, pneumonia and meningitis, have been adopted but the attention of Army medical officers was directed to the successful clinical trials in the American Army—in an Army Medical Bulletin (1944). The Bulletin pointed out, however, that these valuable observations should not be regarded as providing good reason for the uncontrolled use of sulphonamides to prevent all manner of infections. Toxic reactions of, and

sensitization to, these compounds were stressed, but the Bulletin did not forbid this means of prophylaxis but implied discretionary powers to senior medical officers should they at any time think it necessary to protect the health of an Army and to conserve man-power at critical periods. Instances have already been reported where the *N. meningitidis* had been cultured from a swab taken from the nasopharynx of a patient convalescent from an attack of meningitis after treatment by sulphonamides. The American observers quoted above confirmed that spontaneous cures are possible and that there was no correlation between the types of meningococcus amongst the symptomless carrier and those who developed meningitis. Regarding the actual sufferer, it is well recognized that the infection is rarely spread by patients. It is perhaps more convenient to isolate him but, as mentioned above, isolation is not strictly necessary because practical experience has shown that if the medical and nursing staff wear masks while in attendance on a patient who has been screened off, no harm results. If the sulphonamide is given in adequate doses, the nasopharyngeal discharges soon yield no positive culture. During the whole of the war period no instance of infection passing from a patient to those in attendance has been noted or recorded. Instances have occurred, it is true, where in spite of adequate dosage by sulphonamides, meningococci have been recovered from a nasopharyngeal swab (Priest, 1941). Van Rooyen and Morris (1941) examined 113 cases after treatment and found 3 patients gave a positive swab. In these instances it is difficult to say whether these were the causative organisms, whether resistant to the sulphonamides or reinfections.

BACTERIOLOGY.

Experience during the years 1939-45 has shown that the recovery of *N. meningitidis* by cultural methods from the blood and cerebrospinal fluid is by no means constant, for instance Harries (1942) reviewing 500 consecutive cases found successful cultures of the organism from the cerebrospinal fluid were obtained in 214 instances (42·8 per cent). On the other hand Copeman (1942) in a small series of 15 cases of the chronic septicaemic form reports positive blood culture in 14 (93 per cent), while Stott and Copeman (1940) in their 17 cases of the same condition recovered the organism in 3 (17·6 per cent). In an analysis of 204 cases in the B.E.F.(France) (Priest, 1941) 198 examinations of the cerebrospinal fluid, carried out under active service conditions, produced positive cultures in 98 (49·5 per cent). In the 98 positive cultures the organism was found to belong to Group I. The work of Van Rooyen and Morris (1941) also showed that the most prevalent organism during the outbreak in France was the Meningococcus Group I. At the same time Banks (1941) and Fairbrother (1940) showed the Group I organism to be responsible for the outbreak in the United Kingdom.

CLINICAL CONSIDERATIONS.

In no previous war has clinical knowledge been so extensively distributed to all medical officers of the Army by Administrative Medical Instructions in the Field, by War Office Memoranda and by the Army Medical Bulletins in order to supply them with the most recent knowledge regarding medical.

surgical and other subject matter. Meningococcal infections were not excepted from these publications, yet, in spite of all, so variable and so sudden may be the onset and so rapid the course of the infection that its true nature has remained obscure until perhaps too late, particularly so in the fulminating forms.

For many years it has been allowed that the sequence of events in meningococcal infections is primarily a rhino-pharyngeal inflammation and catarrh which may at any moment lead to a septicæmia. In many instances, though by no means all, after a varying interval the meninges of the brain and spinal cord became invaded. In order, therefore, to preserve a balance between these two equally important events, the invasion of the blood-stream and the involvement of the meninges, and so as to avoid undue emphasis being placed more on one rather than the other, it would seem proper to divide meningococcal infections into two main groups: I Septicæmic, and II the Meningitic. Group I may be suitably subdivided into (a) acute fulminating in which no signs of meningitis may appear, and (b) subacute and chronic forms which may eventuate in meningitis at any time or may, without meningeal signs, cause many days, weeks, months or years of chronic ill-health with variable constitutional effects. Similarly Group II may be divided into (a) acute fulminating meningitis and (b) a less acute type of meningitis. The latter yields more readily to chemotherapy and seldom gives rise to difficulty in diagnosis.

There can, of course, be no rigid line of distinction between these classes and subgroups for the reason that resultant from the septicæmic state, the meningococci may become lodged in any single one or in a few or in many tissues and organs in the body. It can therefore be easily appreciated how variable the initial symptoms and signs and the severity may be. Experience has shown, both in France and at Home, that both the fulminating and the chronic bacteriæmic forms have proved very puzzling and baffling until either a positive blood culture or the signs of meningitis have revealed the true condition. Comparison with older literature tends to show that no forms hitherto unknown have been reported.

ONSET.

Presumably, with the exception of some antecedent nasopharyngeal catarrh or tonsillitis, it is not until the blood-stream is invaded (to any degree) that real constitutional symptoms arise. A heavy or particularly virulent infection will cause a sudden and fulminant onset. A less acute invasion will give rise to a period of malaise leading to the ordinary form of cerebrospinal meningitis, and in the less acute forms still there will result a chronic septicæmia of varying duration before the meningeal involvement (cases 10, 12). The incubation period therefore of the meningeal form must of necessity be variable and cannot be specified in absolute terms.

Group I (a) Septicæmic Types.—These have formed an interesting group. The acute fulminating—the malignant purpuric fever of older writers—has been characterized by a very sudden onset and a rapidly extending purpuric or a profuse petechial eruption or a combination of the two. Death has ensued

in some of these cases in six hours or less. In France several patients died before they could be admitted to hospital. In other instances, of longer duration, hæmorrhages were to be seen under the skin, under the mucous membranes of the mouth and pharyngeal walls, beneath the nails, in the conjunctivæ and subdermally giving rise to blood blisters on the fingers or toes. In these instances, unless treatment is initiated, a fatal result follows within thirty-six hours (Case 20).

Encephalitic forms, as recorded by Osler, have been encountered and were characterized by restlessness, confusion, stupor, unconsciousness rapidly passing to coma of varying degree. Patients were cyanosed, yet pallid, breathing was stertorous, pulse rapid or perhaps slow, the blood-pressure was low. These encephalitic forms have been associated with evidences of suprarenal involvement; there have been recorded forms presenting mainly adrenal features (McCartney and Banks, 1941). Thomas (1943) thinks that the severity of the cases is measurable by the incidence of gross adrenal hæmorrhage which was found in 18 out of 46 which came to post-mortem. Case 21 is interesting in that the physical signs at onset suggested acute appendicitis. A few hours after operation the tell-tale purpura and, later, the onset of some neck rigidity made the diagnosis clear. A meningococcal salpingitis has been recorded by Kattwinkel (1941).

The actual incidence of fulminating septicæmic cases in an outbreak has not been recorded. In France it was impossible to estimate its frequency.

(b) *Subacute and Chronic Septicæmic Forms.*—In the past, clinical teaching has not stressed these forms and in the textbooks they receive scant attention so that unless there is a coincident outbreak of cerebrospinal fever, the possibility of meningococcal cause is likely to be overlooked or forgotten.

This subgroup is a very important one for the reason that, as already indicated, so many tissues and organs may be attacked by the organism thus causing a variety of symptoms. Many such cases have been recorded. Kennedy (1926) was the first Army physician to publish cases of chronic meningococcal septicæmia and his paper is worthy of study. The first of the four patients died from meningitis after two and a half years of irregular fever. The second developed meningitis six weeks after the onset of fever. The third resembled an acute attack of rheumatic fever lasting from December to February, while the fourth suffered from rigors nearly every day from January to March. Three of them gave positive cultures from the blood. Kennedy stressed that this chronic form is infrequently recognized. In this World War Stott and Copeman (1940) described 17 cases, three only, however, yielded positive blood cultures. They, too, noted the skin eruptions and considered the condition to be more common than is realized during the prevalence of cerebrospinal fever. Copeman (1942) reported 15 cases, collected at a time when meningitis was not prevalent. The blood of 14 of these gave positive blood cultures. The prominent features were such as to lead to diagnosis of acute rheumatic fever, subacute rheumatism, arthritis, influenza, P.U.O., varicella, erythema nodosum, rubella, muscular rheumatism and acute myalgia.

Other authors, Canadian, American and Australian, have also recorded many

instances amongst their respective Armies, so that chronic meningococcal septicæmia should no longer be regarded as a rare disease.

The onset of the illness can usually be stated fairly accurately by the patient causing, as it does, the symptoms of any infection such as malaise, tiredness, general weakness, aching in the body and limbs, feverishness, sore throat, sometimes definite rigors, occasional headaches. Sometimes the descriptions of the patients themselves are particularly apt—"groggy," "off colour," "just like effects of T.A.B. inoculation," "queer," "like the start of an influenzal cold." Superimposed upon these general features there are more characteristic features, the chief of which are joint pains, bone pains, muscle pains, skin lesions and sometimes rigors occurring in such regular periods as to resemble the paroxysms of malaria (Cases 3, 15, 18, 25). With every exacerbation of joint or muscle pain or rigor there occurs an outcrop of "spots". The muscle pains may be localized to one or more groups of muscles, causing intense aching and pain on pressure. The long bones, too, particularly the shins, have been excruciatingly tender. All joints may be involved, more commonly the knees, shoulders, elbows and ankles and the swelling may be periarticular or in some instances there is a synovitis with effusion into the joint. The resemblance to acute rheumatic fever is therefore very close. The associated skin lesions serve in most instances as a most important clue to the true diagnosis and are therefore of special interest. The spots appear suddenly, sometimes singly, more frequently in crops all over the body, the majority appearing on the limbs and trunk. They are bright pink in colour, variable in size and shape. If circular they are usually about one quarter of an inch in diameter, if oval they may be half to three-quarters of an inch in length and slightly less in width. They are raised from the general level of the skin and are tender, sometimes exquisitely, so that patients have often described them as blind boils. Occasionally, in the centre, there is seen a petechial hæmorrhage. Soon they begin to fade, become less tender and may leave a light-brown stain and eventually disappear. Fresh crops may have in the meantime made their appearance along with some exacerbation of arthritis, muscular pains or perhaps with a rigor. When the lesions are larger they tend to be less numerous and they may have as a centre a deep red or purple area, the whole being raised, indurated and tender, resembling erythema nodosum. In the present state of our knowledge it is probable that the cases of "nodal fever" published by various writers have been, in fact, meningococcal.

These types led to Kennedy's dictum "when you see erythema nodosum, think of chronic meningococcal septicæmia."

Again, in the centre of the smaller macules a vesicle may form suggestive in appearance of dermatitis herpetiformis or of varicella, as instanced by Case I. In other patients a punctate erythema is seen which has been mistaken for scarlet fever and rubella, while in other cases patches of erythema may be seen more frequently over various regions of the trunk than over the limbs.

In these subacute or chronic infections conjunctivitis, orchitis, epididymitis (Laird, 1944), and salpingitis have been reported.

The temperature charts in this group exhibit many types of fever, some

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lasting for years, months, weeks or days (Rolleston, 1919; Kennedy, 1926) and Cases 2, 22, 23. Irregularly remittent types, intercepted by periods of apyrexia have often been seen. The charts have suggested an undulant fever or a quotidian, tertian or quartan fever resembling malaria. During these bouts of fever heavy perspirations are frequent. On the other hand, the swinging nature of the fever may suggest an acute suppurative process or, again, the pyrexia may be slight but persistent, while in some instances there has been no pyrexia at all. Reference to the temperature charts in appended cases will show how variable the fever may be in many types of infection. Cases 24, 29 and 30 demonstrate well how minimal the temperature may be when the condition is diagnosed early and adequate treatment instituted.

Many writers have remarked upon the small effect upon the general constitution this chronic infection may exert and spontaneous cures are certainly possible (Case 8). Yet, it should be borne in mind that at any moment during the course of both the fulminating and the less acute or chronic forms not only the meninges but also the parenchyma of the brain and spinal cord may be attacked with suddenness and violence. Therein lies the danger in not being alive to the possibility of a meningococcal infection before this accident happens.

The factor or factors which excite this sometimes very abrupt change from septicæmic to meningitic form have not been well explained by observers in this last Great War but it is likely to be a combination of factors which are thought to initiate the acute cerebrospinal form, that is, acute upper respiratory tract inflammations associated with adverse climatic conditions, excessive fatigue from any cause and sometimes trauma to the head or neck.

Here it would appear opportune to refer to the skin manifestations of meningococcal infection. Sometimes the infective blow of the meningococcus falls more on the skin, subcutaneous tissues, than on the meninges. The eruptions and lesions are considered to be due to: (i) toxins produced; (ii) the meningococcus itself being responsible for macules, papules, petechiæ, purpura, ecchymoses, vesicles, ulcers and dermatomyositis; (iii) a symbiotic effect represented by herpes febrilis and zoster (Mitchell-Heggs, 1942). The tendency of the meningococcus is to produce hæmorrhagic lesions. The skin appearances in the acute fever are rose-pink macules or papules, petechiæ and urticaria (Case 28); petechiæ resembling flea-bites with or without purpura involving skin, mucous membranes of mouth and conjunctivæ; purpura with ecchymoses occur in the more acute cases, they are bruise-like in appearance associated with vomiting or abdominal pain suggestive of appendicitis (Case 23); ecchymoses developing into vesicles.

In the B.E.F. (France) cases, herpes labialis tended to appear early while zoster usually appeared later. The latter appeared to be very selective in its site, sometimes over the area supplied by one or more branches of the 5th cranial nerve, sometimes over the area of supply of the cervical plexus and over small areas supplied by other nerves, as seen in Case 3. More extensive eruptions have been reported by Mitchell-Heggs (1942) who also noted the atypical distribution and long duration. He also reported that in one patient

herpes of mucous membrane and palate led to difficulty in feeding. Angio-neurotic oedema of the chest wall is reported in Case 28. Herpes labialis appears very early—zoster appears about the fifth day, is remarkable for its frequency, its extensive distribution, atypical localization and long duration. Herpes of the mucous membranes of mouth and palate may lead to difficulties in feeding.

Group II: The Meningitis Group.—(a) *Fulminating*: This form has been characterized by its sudden onset and a common history obtained by observers was that the patient had gone to bed feeling well but had been awakened during the night by headache, rapidly becoming severe and unbearable, 42 out of 107 cases (Priest, 1941). Vomiting soon followed and in a very short time patients have been found in their beds or lying where they fell, soiled by their own copious vomitus and fæces, cold, dehydrated, unconscious or comatose. These patients belong to the group which are brought into hospital dead, moribund or in so advanced a stage that no treatment avails. It has been also noted that the skin lesions have not been so profuse or extensive as has been already described in the fulminating septicæmic types but that they are usually represented by scattered petechiæ and purpuric areas of varying sizes. It has been noted too that evidences of parenchymatous involvement of brain and cord (encephalomyelitic form) more frequently occur in this type than in any other.

In the dehydrated patients the temperature has been found to be subnormal but after the adoption of resuscitative measures the temperature has risen to hypernormal limits until adequate sulphonamide dosage has been attained (*vide* Case 17). In these difficult cases the only indication of meningococcal involvement has been the neck rigidity with or without rigidity of limbs, passive movement of which causes great pain. Some of these fulminating cases in Army patients have presented meningo-encephalomyelitic signs referred to by Banks and McCartney (1942). In their special observations these observers have shown that in addition to the above signs there have been evidences of suprarenal involvement leading to a state of coma with rapid, stertorous breathing, signs that have often been noted. As already indicated it has been impossible to draw any hard and fast distinction between the fulminating septicæmic and meningitic forms because they both have become apparent either simultaneously or the one has passed into the other with great speed.

(b) *Acute and Subacute Forms: Cerebrospinal Meningitis.*—Fortunately this type is the most frequent because meningeal signs are in evidence from the commencement and consequently diagnosis has been confirmed by early L.P. and chemotherapy started at once. Usually, a history of premonitory illness can be obtained and on several occasions the gradual transition from the chronic septicæmic to the meningeal forms has been seen and the gradual change in the cerebrospinal fluid from clear to hazy, turbid and eventually purulent in the established meningeal state. The premonitory signs are those due to the blood-stream invasion and have already been mentioned. In the B.E.F. (France) histories from 107 patients showed the onset was sudden, in 19 there were premonitory signs of varying duration. Twelve patients stated that their illness followed some exercise or exertion, e.g. football or training exercises and digging. History of injury to the head was an antecedent in 4. The

cardinal signs of the well-established disease have been headache, vomiting and neck rigidity. The headache is severe and has been described by patients as pounding, throbbing, bursting, splitting, blinding; movement or coughing made it worse

In one case headache was absent. Vomiting was as a rule troublesome and persistent, sometimes projectile, sometimes like that of gastritis. Seventeen patients did not vomit at all until they were given sulphapyridine. In a good proportion of cases, sweating was noted as a prominent feature. The commonest position adopted was a lateral decubitus with head retracted and turned away from the light and knees well drawn up. The mental disturbances reported have been drowsiness, restlessness, delirium, irritability, confusion, dullness, stupor, insomnia, noisiness with violence, hallucinations. Neurologically there has been loss of smell, complete 3rd cranial nerve palsy, ptosis, nystagmus, squint, weakness of external rectus of eye, facial paresis, deafness, general rigidity, hemiplegia, spasticity of one limb, paresis of arms, wrist drop, foot drop, paraplegia, monoplegia, loss of corneal reflex, local areas of anæsthesia or of hyperæsthesia. Pupils have been reported as either normal in reaction, dilated, small, sluggish to light or inactive. Knee-jerks have been reported to be either normal, brisk, sluggish, absent or unequal on the two sides. The abdominal reflexes have been normal, brisk, sluggish, absent, unequal. Babinski's sign has been present, but not invariably so, and has been noted bilaterally or unilaterally. Kernig's sign has been present in a very large proportion of cases but Brudzinski's sign has been observed less frequently. Retention or incontinence of urine and fæces have been noted. The above reflexes and signs have exhibited much complexity in combination and they have been observed to alter much from day to day. Herpes labialis and zoster have already been mentioned, likewise the skin eruptions. The meningococcus tends to produce hæmorrhagic lesions and epistaxis has been reported, sometimes severe. The subconjunctival, subungual and submucous hæmorrhages have also been mentioned above. Concurrent with the well-established disease, acute pharyngitis, tonsillitis, conjunctivitis (Cushing, 1940), arthritis of shoulder, elbow, ankle, wrist and occasionally with effusion into the joints (Case 25) have been reported. Hiccough has been noted as a troublesome symptom.

Instances of pleuritic pain (Cases 4, 5) have been recorded but no permanent cardiac lesion such as pericarditis or endocarditis has been stressed in the literature. The spleen has been reported to be enlarged by some authors but a palpable spleen is unusual. The liver likewise has seldom been enlarged. Traces of albumen in the urine, also hæmaturia have been noted. Sugar and acetone bodies have been found in the urine of comatose patients, leading to a diagnosis of nephritis in the former and diabetic coma in the latter. The occurrence of two attacks of meningococcal meningitis in the same patient within a short period has been recorded by Edwards (1944) in a West African, although this patient had received a course of 35 grammes sulphapyridine given intravenously and intramuscularly. Post-mortem disclosed a superficial abscess over the temporal lobe from the pus of which a direct smear showed meningococci.

The diagnosis is confirmed by recovery of the *Neisseria* from the blood or cerebrospinal fluid. No large-scale statistics have been published as to the frequency of the isolation of the organism from the blood, but all reports show that its isolation is by no means certain even in the fulminating and acute forms. The same has applied to blood cultures from the less acute and chronic forms. It is interesting to note that Muir (1919) and Kennedy (1926) obtained a positive blood culture by puncturing the centre of a papule (*vide* Case 19). Mitchell-Heggs (1942) affirms that a smear obtained by gentle friction over the petechiæ, purpuric lesions or vesicles, may show meningococci on direct microscopic examination even when the blood culture is negative and nearly always when it was positive. In Kennedy's case the blood was also positive. Stott and Copeman (1940) believe that although the isolation of the meningococcus from the blood is the only certain method of diagnosis, the chronic septicæmic form is so characteristic that bedside diagnosis is simple (Case 14). Dickson *et alia* (1941) are of the opinion that in spite of all precautions and special methods, a positive result is largely a matter of chance.

In the well-established condition of cerebrospinal meningitis a turbid, thick or purulent cerebrospinal fluid under increased pressure has been a very constant feature and in some instances the fluid has been so thick and viscous that it could not be withdrawn through a needle. The fluid has shown an excess of polymorphonuclear cells and the presence of the Gram-negative *Neisseria* has been found in the stained film far more frequently than its recovery by culture. In those chronic meningococcal septicæmic states where the onset of meningitis has been gradual (Case 9), the transitional stages from hazy to thick and purulent were noted as the disease progressed. The hazy specimen has shown a preponderance of lymphocytes to be followed soon by the ascendancy of the polymorphs. The polymorphs have reached 50,000 or more per c.mm. In Cases 13 and 24 which were instances of the septicæmic phase and whose sole neurological symptom was headache in the latter and headache and numbness of fingers in the former, meningococci were recovered from both the blood and cerebrospinal fluid. In Case 15 there was only slight stiffness of neck.

As with the blood, cultures of the *Neisseria* from the fluid have been equally inconstant, e.g. in Fairbrother's series (1940) of 51 cases in the Western Command from only 23 was the meningococcus recovered and all were Group I. Protein content has been invariably increased while the chlorides have been diminished. The literature shows that the blood-counts show an enormous increase in total leucocytes, e.g. up to 52,000 per c.mm. (Cushing, 1941) with a high relative increase in polymorphs. On the other hand Stott and Copeman (1940) report a leucocyte count of 7,000 with polymorphs at 70 per cent with a positive blood culture. The erythrocyte sedimentation rate, when recorded in the literature, has very nearly always been raised.

DIFFERENTIAL DIAGNOSIS.

Some of the conditions with which meningococcal infections have been confused have already been indicated, such as influenza, rubella, scarlet fever, chicken-pox (Case I) and dermatitis herpetiformis. The resemblance, however,

has been superficial only, and an accurate history and more careful clinical examination would have avoided these errors. Similarly, these infections have received diagnostic labels of enteric group. Endocarditis of meningococcal cause with permanent damage has not been recorded but it is allowed that the meningococcus can become implanted upon an endocardium already damaged by more common infections. Clinically, the close similarity of meningococcal infection to subacute bacterial endocarditis has been noted. The mimicry of acute rheumatism has led to many mistakes, especially when arthritis has been a prominent feature. Observers agree that salicylates are not specific in their action as is the case in rheumatic fever (Case 15). It has been shown that sulphonamides have an immediate and rapid effect upon the meningococcal form of erythema nodosum (Case 6) which serves to differentiate it from that associated with rheumatic fever and tuberculosis. The chronicity and irregular nature of the fever has suggested latent tuberculosis and likewise, if of undulant character, an infection by *Brucella melitensis* or *abortus*. Patients passing rapidly into coma with sugar and acetone in the urine have been encountered (Ward and Driver, 1940; Priest, 1941) but lumbar puncture has shown the true cause of the coma. The same procedure has on occasions served to distinguish between a *Neisseria* infection and a subarachnoid hæmorrhage. The likeness to malaria because of almost regular periodicity of a raised temperature, sometimes with rigors, has been noted by many observers (Crawley, 1942; Kilham, 1942; Priest, 1942) (Cases 15, 18, 25). The failure of quinine in contrast with the immediate success of sulphonamides in bringing the fever to an end has been well shown (Case 15).

Several cases have been reported where the symptoms, signs and course of meningococcal infections have resembled those of trench fever (Stott and Copeman, 1940; Priest, 1941) even to termination in meningitis. Splenic enlargement, reported to be frequent in trench fever, has not been the case in meningococcal septicæmia. During the years 1915-17 trench fever and cerebrospinal fever were concurrent and as the incidence of the chronic septicæmic states is known to increase during an outbreak of cerebrospinal fever it is conceivable that in those years some of the trench-fever cases were in fact instances of meningococcal infections (Bull. of War Med., 1942). It is worthy of remark also that in discussing the differential diagnosis of trench fever (Trench Fever, 1918) meningococcal septicæmia is not referred to.

Finally, intermingled with the cerebrospinal-fever cases in the B.E.F. (France) there were instances of other cerebral conditions resembling cerebrospinal fever in its early stages; these included meningism, encephalitis lethargica, encephalitis associated with rubella, lymphocytic meningitis, tuberculous and pneumococcal meningitis, concussive and post-traumatic states. Fortunately all these conditions suggested to medical officers the necessity of a lumbar puncture to establish proper diagnosis.

SEQUELÆ.

Owing to the necessity of clearing the hospital beds it was impossible to follow up patients, especially those who showed some residuum of the infection

in the form of deafness, strabismus, facial palsy, paraplegia and monoplegia. But it was early realized that as many patients as possible should be kept in France to complete their convalescence. In February, 1940, the General Hospitals at the Base (Dieppe) were instructed by the Medical Directorate H.Q., B.E.F., to send their patients convalescent from cerebrospinal fever to No. 1 Convalescent Depot which was situated near Dieppe in ideal surroundings. In this way it was possible to observe a small series of 50 convalescents. These men were seen weekly. Convalescence was rapid. Of the 50, three men complained of troublesome headache for a little while and a few complained of pain at the site of the lumbar puncture. However, these few, aided by the example of those who were progressing to a perfect recovery, also got well and eventually returned to duty. Up to 1939, cerebrospinal fever was, with good reason, regarded by all as a terrible and fatal disease until the advent of chemotherapy. The picture was soon completely changed. In the Commands at Home, Army medical officers had been advised to exalt and stress the therapeutic efficiency and certainty of the sulphonamides to their patients as soon as they were well enough to understand, and to reassure not only them but also their relatives and friends from the very commencement, either orally or by letter, that the outlook in the great majority of cases is now no longer despairing or hopeless but rather that the prospect of return to former health is good. Should some complication such as deafness or facial palsy remain, reassurance was still the policy, for it is known that some of these sequelæ are transient (Cases 22, 27). It was early learnt that it was a mistake to allow these recovering patients to go to their homes on sick leave where perhaps ignorant and misplaced sympathy not only retarded a man's recovery but also brought about some added psychological state. The rule in Commands was that patients from Military Hospitals were transferred to suitable convalescent homes (British Red Cross and St. John) where they were seen by Army medical officers in conjunction with the civilian practitioner in charge. Reassurance and encouragement were continued and in due course patients were transferred to the Military Convalescent Depots where they, along with hundreds of other men who were being reassured, were encouraged and rendered fit to return to duty.

Consultants in Commands at Home found great difficulty in following up cases and it has not yet been possible to ascertain statistically how many men were invalided from the Army for some disablement directly due to meningococcal infection of the brain or meninges, e.g. paraplegia, monoplegia, bilateral deafness, etc. and how many men ended their Army service in a psychiatric unit or were invalided for some psychiatric condition. Unless very carefully handled by thorough but not too frequent examination and unless constant reassurance is given, some psychiatric sequela, commonly hysterical, has been produced.

TREATMENT.

During 1939-40 in the B.E.F. (France) the drug used was sulphapyridine throughout, either by tablets or the soluble form made up in ampoules ready

for immediate intravenous or intramuscular injection. In the early prevalence of cerebrospinal fever no standard of treatment had been laid down and medical officers were giving the drug in varying doses according to the circumstances of the individual case. Some medical officers were following the dosage recommended by Banks (1939). On January 31, 1940, a memorandum from the Medical Directorate H.Q., B.E.F., was issued advising all medical officers with the Force as to the uses and dosages of sulphonamides in general and of sulphapyridine in particular. This memorandum also stated that the combined use of anti-serum and chemotherapeutic agents does not appear to enhance the value of the latter, but that if a medical officer wished to give serum, the intravenous and intramuscular routes should be used. Eventually, however, anti-serum was discarded entirely. The dosage advised in this memorandum was 2 grammes by mouth immediately, followed by 1 gramme every four hours night and day for a period of thirty-six hours and thereafter 1 gramme three times a day for three or four days. If vomiting persisted 1 gramme was to be given intramuscularly every four hours with change to the oral route at the earliest opportunity. The doses suggested above were merely a guide and in severe fulminant cases it sometimes became necessary to give the drug intravenously. There were no fatalities reported from agranulocytosis in France although instances were reported of the granular white blood cells falling to a low level. Medical officers were advised to have leucocyte counts made weekly and if the leucocytes fell to 3,000 per c.mm. sulphapyridine was to be withheld and intramuscular injection of sodium pentnucleotide given. Cyanosis with sulphapyridine at first made medical officers somewhat chary of continuing the drug but the memorandum quoted stated that cyanosis *per se* was, as a rule, no bar to the continuance of sulphonamides. In the B.E.F. the maximum dosage for one patient was 81 grammes over a period of ten days and the minimum 14.5 grammes over a six-day period. The average dose per patient in a series of 191 cases was 34.4 grammes over a period of 7.9 days. In no instance was real idiosyncrasy to sulphapyridine noted but in a few cases a scarlatinal or morbilliform rash was seen and sulphonamide fever was noted occasionally.

As the war progressed sulphathiazole became the drug of choice in Army units although later still some Army medical officers preferred the even newer preparations, sulphadiazine and sulphamethazine; all had equal success in rendering the meningococcus inactive in similar dosage.

It has already been mentioned that penicillin has proved equally successful in the treatment of meningococcal meningitis. To those few individuals who have been found to be susceptible to sulphonamides while undergoing treatment for some other septic conditions, the administration of penicillin would be a necessity rather than a choice. Finally, it was soon learnt in France that the earlier in his disease—cerebrospinal meningitis—the patient received adequate treatment by sulphonamides, the better the result. Thomas (1943) is very emphatic: "If all patients could be diagnosed and treated at the onset of the first symptom it is my firm belief that the mortality would be reduced to zero."

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Case 1.—Aged 32. January 19, 1942. Bad cold five days ago, headache and shivering. Two days later spots like pimples appeared on legs. Herpes labialis. Sore throat and general aches and pains. On examination: Papular and vesicular eruption on legs, buttocks and back. Heart, lungs, abdomen and C.N.S. n.a.d. T. 102.6 to 103.6 and 102.2 on successive evenings. Sulphapyridine started January 22. Two tablets four-hourly. Rapidly responded and soon felt quite well. Total 693=10.5 grammes. He was sent to hospital labelled "chicken pox." Temperature chart attached. *Meningococcal septicæmia*.

Case 2.—Aged 26. January 17, 1942. November 2, 1941, suddenly ill with pains in legs, arms and shoulders and high fever. This lasted for a week, improved, went on leave and had occasional feverish attacks. Admitted on December 13 and continued to have periodic fever. With the fever, headache, rigor and sweating and felt quite well in between. Suggestive of malarial attack. Pain in splenic region. December 27. Scattered erythema seen on abdomen and tender spots like *erythema nodosum* on legs. Two blood cultures negative. Leucocytosis highest 22,000 during attack, 8,400 in between. E.S.R. 48. Urine n.a.d. No malarial parasites in films. No response whatsoever to quinine hydrochloride. Two courses—one 90 and the other 80 grains total. January 16, 1942. Sulphapyridine given four tablets four-hourly, gradually reduced, total 22 grammes. Convalescence and recovery good. Temperature chart quartan malaria. (*B.M.J.*, 1942, 2, 129.)

Case 3.—Aged 26. February 18, 1942. Pain in epigastrium and lower ribs—worse on coughing for past week. February 22 six or seven discrete patches of *vesicular rash*, 3d. piece in size, on left arm, three or four vesicles in each patch. Diagnosed *Zoster*. February 23: Red, raised, erythematous spots on right arm, *not vesicular*. Crops of these coincided with slight feverish attacks. No rigors but sweating marked. Feels ill with fever, well in between. Two blood cultures negative. Leucocytes 9,150. E.S.R. 20. Polys. 54 per cent. Irregular fever till March 15. Sulphapyridine 20 grammes over nine days. Discharged convalescent March 28. Responded immediately.

Case 4.—Aged 41. March 20, 1942. One week ago *had cold with pain in chest*—gradual increasing *loss of use of legs* two days ago, headache severe, semicomatose. T.102. Cyanotic, pale face. P.64, R.26. Pupils small, no light reaction. Ptosis R. and L., limited eye movements. Arm jerks negative. Abdominals present. K.J.s and A.J.s increased. Clonus present L. and R. Plantars extensor. Neck stiff. Kernig's present. C.S.F. pressure increased, turbid. Polys. 90 per cent. Meningococci seen in smear culture after seven days gave meningococcus Group I. Both legs spastic paraplegia. Semicomatose, sweating heavily. No response to sulphapyridine or soluseptasine I.V. and I.M. W.B.C. 17,350. Polys. 88 per cent. Died March 21. C.S.F. with *spastic paraplegia*. One other case seen in B.E.F. (France).

Note: A typical onset resembling pleurisy. Well advanced before sulphonamide treatment commenced.

Case 5.—Aged 18. March 23, 1942. Pain in R. chest for past fourteen days suggestive of *pleurisy*. Did not look well. No physical signs in chest. X-ray negative. T.99. March 27: *Erythema nodosum* L. leg T.102.2. March 29: *Erythema nodosum* R. leg more extensive than L.; malaise, headache and low irregular fever continued. E.S.R. 60. Leucocytes 8,700. Polys. 58. Blood culture negative. April 9. Rash on arms 3 in. x 2 in. erythema areas, raised, tender. April 11: Sulphapyridine 26½ grammes over six days. Good and rapid recovery.

Note: Onset suggested pleurisy. Erythema nodosum.

Case 6.—Aged 26. April 2, 1942: "Vincent's" infection of throat in January. Seven days ago "influenza" with sore throat. No previous rheumatism. Multiple, localized, raised, tender, indurated areas of *erythema nodosum* over part of both legs. Tonsils quiescent. Stiffness R. knee. No effusion. *Sod. salicyl.* W.B.C. 4,150, Polys, 52. Post-nasal swab meningococcus negative. E.S.R. 41. April 6: Sulphapyridine given to 12th. Erythema cleared up at once. E.S.R. 19. April 6: Blood culture sterile.

Case 7.—Aged 22. March 18, 1942. Four days ago malaise and pains in joints. Two days later painful swellings of joints. March 18: Pain in both knees and ankles, R. toes, R. fingers. Swellings seen on arms, feet, legs and chest. 3 to 5 cm. in size, red at periphery and purpuric in centre. Firm, very tender and painful freely moveable over tissues

beneath. T. varies 99-102. Heart n.a.d. Tonsils actively inflamed. Lesions very suggestive of meningococcal infection. Blood culture impracticable. W.B.C. 11,200. Polys. 75 per cent. March 20: Sulphapyridine total 26 grammes over nine days. Rapid response. Discharged April 2 to Convalescent Home. Over one indurated area there was a small vesicle. Case shows *erythema nodosum with purpuric vesicular elements*.

Case 8.—Aged 27. April 22, 1942. Felt ill for seven days and noticed lumps on his legs. Later felt stiff and could not walk. *Knee-joints ached* and legs felt tender under lumps. Neck felt swollen and stiff and painful in occiput. Noticed two small lumps on arms. Throat not sore, tonsils removed six months ago. *Throat swab yielded meningococcus Group II*. Agglutination test for meningococcus negative. Blood culture negative. W.B.C. 5,900. Polys. 62. Lumps tended to become confluent. T. 99.6. Frontal headache. Slight pain in neck. E.S.R. 70. April 28: All skin lesions faded away. Patient's serum did not agglutinate to meningococcus obtained from throat. Lugol's iodine and calc. lactate. May 5: E.S.R. 43. May 17: No skin lesion, no fever, throat swab negative. E.S.R. 38. Sulphapyridine not given. *Example of spontaneous cure*. E.S.R. on discharge 18 (June 6).

Case 9.—Aged 25. May 11, 1942. May 11: Occipital headache and giddiness. Admitted to C.R.S. for five days and returned to unit quite well. Headache and giddiness recurred on May 25 and admitted to hospital. T. 99. Flushed. No neck rigidity. No Kernig. June 5: *Blood culture gave meningococci (atypical)*. June 7: L.P. fluid under slight pressure, meningococci not grown. Clear fluid. Cells 14 (lymphocytes mainly). Fever irregular since admission. No rash or spots. Sulphapyridine 20 grammes. Headache disappeared, rapid convalescence. *Example of septicæmia with meningeal irritation but not sufficient infection to cause purulent fluid*. Similar case in France. If sulphonamide had not been given he might have developed cerebrospinal meningitis with purulent C.S.F.

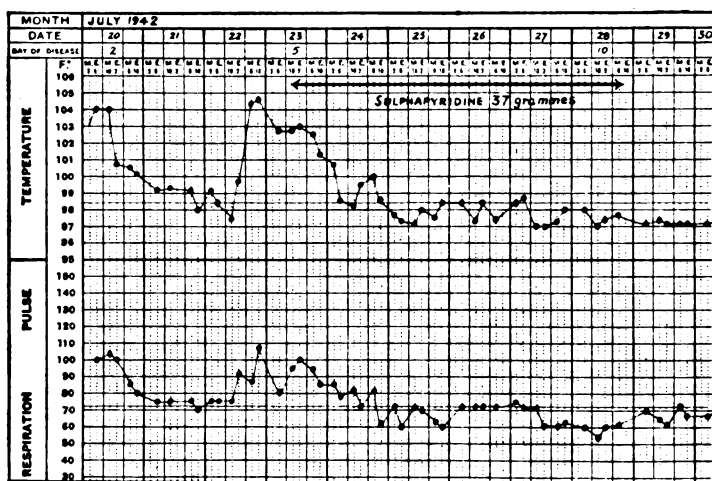
Case 10.—Aged 24. May 22, 1942. On May 22 complained of persistent headache and later stiffness of legs. May 23: *Blotchy rash* on arms and thighs which soon faded. Also sore throat and pains in neck. No vomiting. Has felt shivery several times and has sweated a lot. Headache is worst symptom. No abnormality noted in C.N.S. except K.J.s and A.J.s were not obtained. May 29: T. 102, pharynx congested. May 30: Still febrile, headache, K.J.s and A.J.s obtainable. May 31: Headache much worse, neck stiff. L.P. 6 c.c. normal-looking fluid. June 1: Throat swab negative for hæmolytic streptococci. Leucocytes 12,000. Polys. 74 per cent. Blood culture negative. C.S.F. no cells, no organisms. June 6: Headache present, sweating much. Erythematous nodules keep recurring on limbs, fever continues, remittent in type. June 6: Evening headache severe. Neck rigid. Kernig positive. L.P. 25 c.c. opaque, light yellow fluid, slight pressure increase. Cells one polymorph; *culture gave meningococci*. Drowsy. M & B 693 given, 33½ grammes. Responded well and discharged to Convalescent Home July 3. *An instance of chronic septicæmic form from May 22 to June 6 with headache, joint and muscle stiffness and recurrent rash and then meningococcal meningitis*.

Case 11.—Aged 24. June 17, 1942. June 17: Sudden onset, started with cold. Throat sore T. 100. Shivering, headache, pain in back, sweating, thirsty. June 18: Pains in legs. June 19: Headache persistent, neck stiff, spots on hands and feet, wrist-joints aching. T. 100. Large blotchy spots ¼ in. to ½ in. diameter on thenar eminences, on forearm, soles and inner sides of feet. Slightly raised, not tender. June 24: Afebrile. Blood culture negative. W.B.C. 18,900. Polys. 61. Throat swab for meningococci negative. June 28: Much the same. Sulphapyridine 13 grammes—cleared up at once. Discharged to leave. An officer patient. Fairly typical septicæmic form.

Case 12.—Aged 35. July 19, 1942. Started suddenly July 19 with shivers, headache, pain in neck, very limp and weak. July 20: T. 104. Throat injected. Blood film, no malarial parasites. W.B.C. 14,200. Polys. 80. A number of red spots, small, over

trunk, flanks and thighs. July 21: Feels well, spots gone. July 22: Evening rise of temperature to 104.4 feels ill, headache occipital, shivery feeling, new crop of spots all over body. July 23: Marked neck rigidity. T. 102.8, severe headache, Kernig positive. L.P. pressure increased, slightly turbid C.S.F., 1,150 cells, polymorphs, film showed Gram-negative diplococci. Incubation gave growth of Gram-negative diplococci which died on subculture. Sulphapyridine 37 grammes over four and a half days. Rapid response. August 2: L.P. clear fluid normal pressure. Convalescence rapid.

Note: Example of septicæmic form passing to meningeal form.



CASE 12.

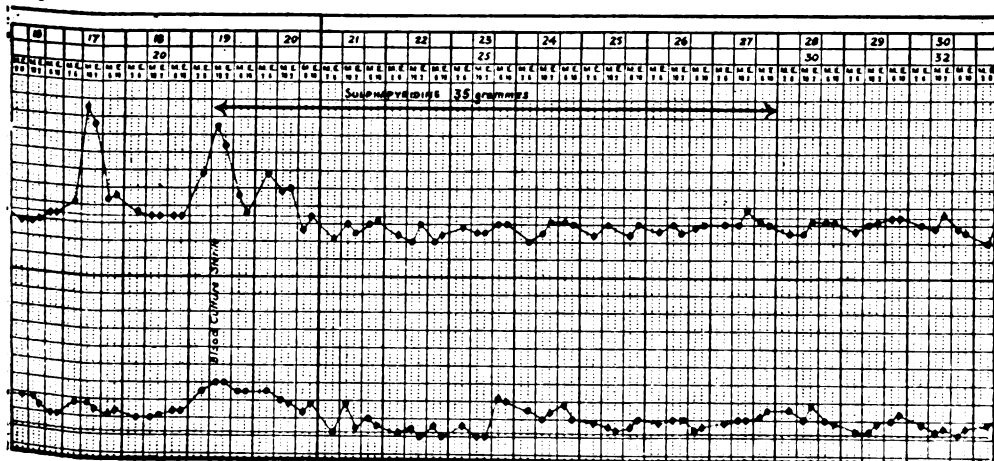
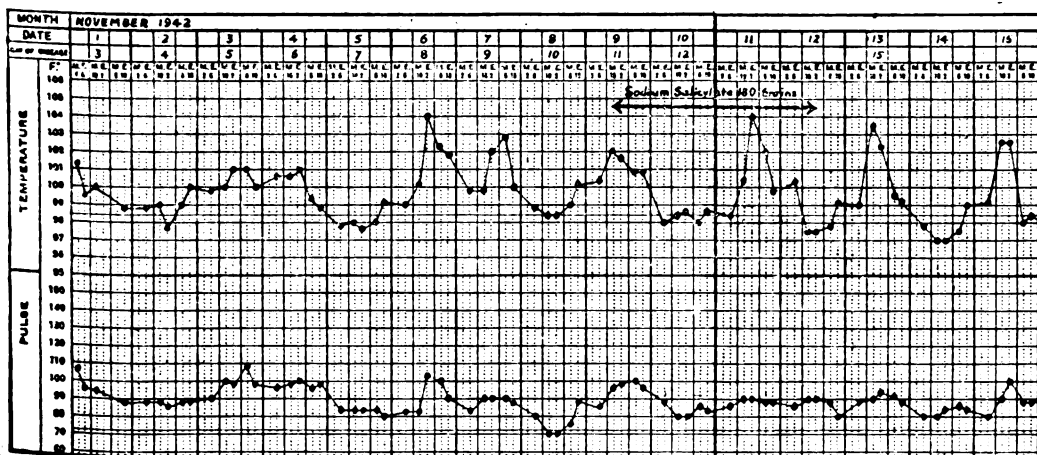
Case 13.—Aged 29. August 12, 1942. Two months previously had two attacks generalized limb pains, rash on arms and legs; reddish spots, some small, others on thigh were large, raised and tender. Complained of headache, aching over sacral area, pains in limbs and pains in R. chest for two days. Headache occipital continuous, sometimes severe. Limb pain seems in the muscles. Pain in chest in region of 5th costal cartilage, not affected by breathing. Sometimes numbness and tingling of fingers. T. 100.4. P. 86. Rash macular, varying sizes from pin-head and larger, plum red, extensor aspect arms, inner surface mid-thigh regions, round each ankle, few beneath each clavicle, one large area over upper region L. sternomastoid. C.N.S. no abnormal physical signs. Heart healthy, lungs also. Over 5th right costal cartilage is a definite swelling, not discoloured, 1½ in. circular, tender on pressure. L.P. slightly turbid fluid, pus cells show Gram-negative diplococci. August 12: Blood culture grew Gram-negative diplococci. W.B.C. 12,000. Polys. 80 per cent. Sulphapyridine 31 grammes over seven days (August 13 to 20). August 31: Prontosil 31 grammes in seven days. W.B.C. 3,800. Prontosil stopped. September 10: W.B.C. 10,000. Organism = Group II Meningococcus. Responded well. *This case shows a long-standing meningococcaemia with organisms recovered from both blood and C.S.F.* The irregular fever settled down after prontosil. All pains, headache, rash and swelling over rib disappeared completely.

Case 14.—Aged ?. July 21 (approx.), 1942. One week before admission he had a throbbing pain in L. shoulder and upper arm, soon passed. The day before admission pain recurred and he did not feel well generally. He thought he was developing meningitis but why he thought this he could not explain. His neck was a bit stiff. On July 28 temperature was 102° F. and his chart showed slight elevations for two or three days previously. Typical rash of meningococcal septicæmia present on forearms and lower legs and scattered over body. It was polymorphic, macular, papules or maculopapules,

a few of which had hæmorrhagic centres. In addition two or three deeper subcutaneous nodes with reddened surface, most typical on forearm; these were tender. No polyarthritis. Blood culture taken when fever was 103 was sterile. Sulphapyridine started, response rapid and dramatic. Dose not stated. Clinical appearance and history characteristic.

Case 15.—Aged 25. November 1, 1942. Yesterday pains in head and weakness in both legs, hot and cold feeling, nausea, shivering fits. Has been in Syria. In U.K. since July, 1942. Irregular fever, herpes labialis. No meningococcal or malarial signs. Spleen not palpable. Lungs clear. November 8: Sore throat, pain and stiffness in wrists, knees and ankles. L. tonsil slightly inflamed. Heart and lungs appear normal. Sod. sal. given with no effect. November 9: Pain in knee-joints. November 11: Rose spots on legs—intermittent pyrexia. ? rat-bite fever ? sandfly fever. Blood film no malaria parasites. Agglutination for enteric group and abortus group not positive. Urine culture nil grown. W.B.C. 21,000. Polys. 63. November 13: Shivering, more spots on legs and abdomen, intermittent fever. *Clinically a remarkable resemblance to malaria.* Irregular fever at first and then settling to an almost regular quartan periodicity. Leucocytes fell to 6,000. Polys. 61 nearly at end of sulphapyridine course. Blood cultures negative. C.S.F. normal, November 19. Published in *B.M.J.*

Note: Chart resembles malaria.



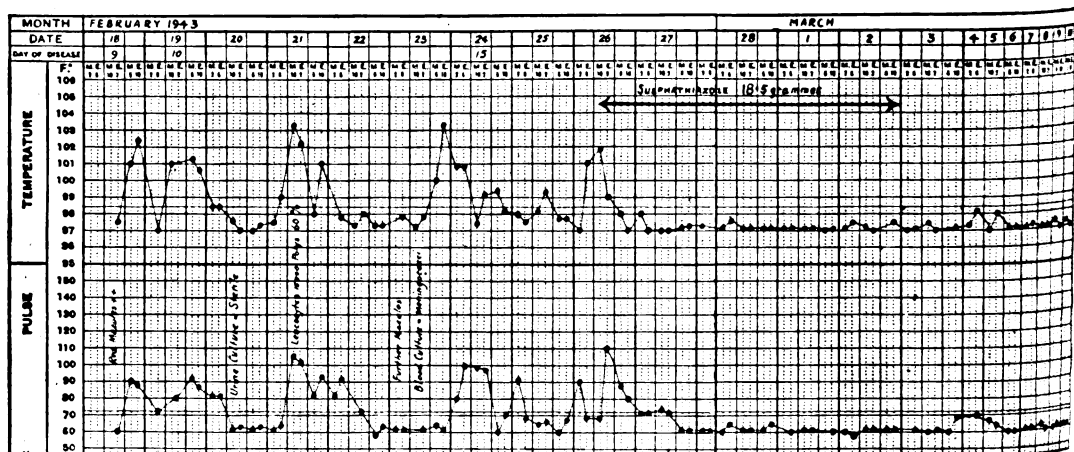
CASE 15.

Case 16.—Aged 37. November 23, 1942. Admitted unconscious having complained of headache and giddiness in morning. T. 101. Petechial rash body, arms, legs. Petechial hæmorrhages beneath finger-nails and beneath toe-nails. Subconjunctival hæmorrhage L. eye. Neck very rigid. Kernig marked, photophobia. L.P. 7,500 polymorphs. Protein 450. Films show Gram-negative diplococci; culture, pure growth *meningococci*. Sulphapyridine given I.V. and I.M. at once and later orally. November 24: Still unconscious. November 25: Conscious but completely deaf. November 27: hæmorrhages as on admission. November 30: Better—can hear a little. December 2: Pain in arms and shoulders; legs painful on movement. Pupils react normally. All tendon reflexes increased equally. Plantars flexor. December 9: Some headache and deaf L. ear. L.P. repeated, clear fluid, 7 cells/c.mm. December 15: Getting up. T. normal since December 5. Total 29 grammes sulphapyridine.

Note: A case of C.S.M. with subconjugal hæmorrhages fingers and toes and subconjunctival hæmorrhage.

Case 17.—Aged 34. November 25, 1942. Admitted unconscious having complained earlier of pains in legs, head and stomach, vomiting and feeling cold all day before. Pallid and cyanosed, small pupils, marked photophobia, rigid in epigastrium region—pulse feeble at 40/min. Kernig not present. Epigastric muscles seem rigid and painful. On admission: Lies flexed and unconscious—restless—petechial rash arms, legs and abdomen. Pulse not felt at either wrist, cold and clammy. Feet and hands very cold. Incontinence of bowel. Neck rigidity present—Kernig present. Heart feeble action, rate 80. Temperature sub-normal 97. L.P. very turbid under pressure, cells 18,000 c.mm. protein 900, chlorides 630. Film intra and extracellular Gram-negative diplococci, culture yielded pure growth of-meningococci. Blood culture sterile. Sulphapyridine I.V. and I.M. with I.V. saline drip. Retention of urine; catheterized. November 27: Became conscious and complained of headache. Neck rigidity slight. November 30: Doing well. Retrograde amnesia otherwise no abnormal neurological signs. Abscess L. arm at site of I.V. injection; incised and the temperature dropped. Febrile portion of illness from November 30 due to this abscess—*Staphylococcus aureus* formation. Total sulphapyridine 10 grammes I.V. and 12 grammes orally = 22 grammes. Case exhibiting no fever in association with meningococcal meningitis but temperature rose after resuscitation methods.

Case 18.—Aged 18½. February 18, 1943. On February 10 had frontal headache, shivery feelings, no vomiting, no pains. On admission covered with red macules on arms and trunk. Throat clear, heart and lungs healthy, spleen just palpable. X-ray chest nil abnormal. T. 101-102. February 21: Macules fading, spleen not palpable.



CASE 18.

February 23: In evening fever returned and a further crop of papules surrounded by zone of erythema appeared. Spleen easily palpable. Very tender over L. tendo Achillis. The rash situated on trunk and legs. *Blood culture gave copious growth of meningococci.* February 26: Further sharp rise of temperature with a fresh crop of spots, flat papules with surrounding erythema. No rigor. No neurological signs. Sulphathiazole started. Other agglutinations T(H) 1/25. A 1/500. Abortus group negative. W.B.C. 15,000. Polys. 60. Sulphathiazole 15½ grammes; Convalescence established. *Temperature chart resembled malaria of tertian character.*

Case 19.—Aged 29. February 18, 1943. Pain in ankles and knees sixteen weeks before admission, flitting from joint to joint. At same time tender red swellings size of pin's-head to a shilling had appeared in crops every two or three days. These persisted for a few days and then faded away. He had managed to carry on. Two weeks before admission had pains in elbows and wrists. No swelling of joints. Rheumatic fever at 6 years. Tonsils removed at 8 years. On admission, pale, unhealthy. T. 101·4. P. 112. Tender red area size of half-crown flexor surface of forearm. Nothing abnormal found in any system. Urine normal. Progress showed completely irregular fever. Sweating profuse when febrile. Crops of skin lesions tended to appear with each spell of fever. Skin lesions were small raised erythematous macules, sometimes with petechial centres 2 to 10 mm. in diameter, mainly on limbs and trunk. On one occasion a group of macules on R. malleolus had vesicular centres. Lesions lasted two or three days and disappeared. Nodules also appeared, intensely tender mainly over tendons near a joint and over sub-cutaneous bony surface. April 15: W.B.C. 7,000. Polys. 56. Hb. 80 per cent. R.B.C. 4,400,000. May 3: W.B.C. 16,000. Polys. 73. Blood cultures April 6, April 15, May 3, May 5, May 6, May 7, May 8 all negative. Blood taken during febrile phase. Urine showed trace albumen. *Culture taken from a skin lesion May 8 showed a few Gram-negative diplococci but culture sterile.* Sulphapyridine started May 8. Rapidly cleared up and became fit for discharge May 22. Total sulpha-drug 30 grammes. *An example showing four and a half months' irregular fever with skin lesions. Characteristic of meningococcal septicæmia.*

Case 20.—Aged 22. March 24, 1943. Well until morning of 24th—complained on waking of backache, aching spreading to limbs. Evening temperature 100. Some head-ache during day with nausea but no vomiting. Felt as if she had a chill. On admission felt hot, T. 104° F. Pulse rapid, flushed appearance. All reflexes present and equal, plantars flexor, no Kernig. Heart, lungs, abdomen nil to report. Cranial nerves normal. March 25 purpuric rash with ecchymoses early (3 a.m.) morning spreading over whole body, increasing in intensity. Temperature 97. 9.30 a.m. pulse 120, dull ache in limbs, purpuric rash now extensive. Hæmorrhage beneath mucous membrane of throat and posterior pharyngeal wall. Spleen just palpable. Blood: R.B.C. 5,100,000; W.B.C. 4,500. Polys. 33. No clot formed in three hours, culture none reported. 12.45 p.m. *sudden collapse and died.* P.M. Heart showed slight vegetation mitral valve. Small hæmorrhage below aortic valve beneath endocardium. Spleen 230 grammes, firm. *Suprarenals R. 109. L. 89, medulla of both intensely congested and hæmorrhagic* but suprarenal anatomy not disturbed macroscopically, *congestion of cortex.* C.S.F. showed a few pus cells and many extra and intracellular Gram-negative diplococci. Cut surface of brain showed small vessels to be prominent. Diagnosis: *Acute meningococcal septicæmia affecting suprarenals and involving meninges and C.S.F.* The leucocyte count of 4,500 is significant and suggests poor response to infection.

Case 21.—Aged 23. June 8, 1943. Admitted June 8 complaining of pain in R. lower quadrant of abdomen and vomiting; pain radiated to back and to L. side. Pain started nine hours before admission. T. 101·4, P. 120, R. 28. Extreme tenderness R.I.F. No tumour. Lungs normal, heart normal, C.N.S. normal except for headache. Urine a few pus cells only. Operation: Appendix removed, pathological but not acutely inflamed. June 10: Profuse purpuric rash appeared over trunk and upper and lower limbs. Slight neck rigidity. No other abnormal physical signs. L.P. hazy fluid, not under pressure

with 1,750 polys. per c.mm. *Meningococci found in film.* Sulphapyridine commenced, dosage not stated, temperature fell to normal in eight hours and she made an uneventful recovery. *An interesting example of an acute septicæmia with adrenal involvement suggesting an acute abdomen, passing on to meningitis.* Timely sulphapyridine saved her life.

Case 22.—Aged 32. November 11, 1943. Returned from W. Africa June 30. He had had three attacks of malaria. Admitted November 15 for headache, backache and irregular fever. Malarial parasites not found in many blood films. Fever did not respond to mepacrine and pamaquin course. Fever on the whole was completely irregular, but at one period, in spite of antimalarial treatment, the fever showed a tertian and quartan periodicity. Pulse-rate corresponded to temperature. E.S.R. 7 mm. Blood culture sterile. Fever continued up to February 17 when sulphapyridine was commenced, thereafter fever subsided and he got well. *An example of chronic septicæmia for three months, with very little constitutional disturbance.* No rash of any kind reported. Leucocyte count not reported.

Case 23.—Aged 32. December 27, 1943. On sick leave. December 23: Both ankles swollen. A few days before had pain in chest with dyspnoea. Some cough little sputum. Ac. rheumatism 1933. Heart no organic lesion. Lungs healthy. Abdomen nil abnormal. Pain on moving ankles, wrist and L. shoulder. Slight œdema both ankles. X-ray chest nil abnormal. X-ray screen heart nil to report. Urine trace albumen, no deposit. Mist. sod. sal. Blood urea 50 mgm. o/v. W.R. negative. E.S.R. 35. No response to sodii salicylas. Low irregular fever continued. January 10: Uroselectan test renal tract normal. January 19: R.B.C. 5,000,000. W.B.C. 7,200. Polys. 71 per cent. Agglutination abortus group negative. No enlarged glands. Urine still shows albumen, no casts, no pus cells, no T.B. grown. Sputum no T.B. Has slight pain in R. iliac fossa. January 28: Urine alb. present scant R.B.C. February 7: Mild irregular fever continues. Still tender in R.I.F. Barium enema nil abnormal. Blood culture negative. February 10: E.S.R. 64. February 13: W.B.C. 6,400. Polys. 79 per cent. February 16: T. 100 feels well. February 19: Glands in neck, axillæ and groins. Paul Bunnell negative. Gland biopsy from neck showed no evidence of lymphadenoma. March 2: Conjunctivitis and ptosis. March 12: Spleen not palpable—no petechiæ. February 13: W.B.C. 12,000. Polys. 81. March 15: Urine culture negative. B.P. 80/60. Blood culture again negative. March 21: Possible meningococcal septicæmia. Fever continues showing greater excursions. Pulse-rate corresponds. Sulphathiazole given March 21 to March 26. 27 grammes. No response. April 9: Sulphapyridine given. April 10: Vomiting, incontinent, but no other signs. Marrow smear within normal limits. Blood transfusion 1 pint. April 2: Pain in elbows. April 6: Blood culture of March 31 *meningococcus isolated.* April 10: Suddenly *collapsed and died.* P.M. showed recent mitral endocarditis; brain and meninges macroscopically normal. Spleen about normal in size and firm. Probably became sulphonamide sensitive. *Prolonged illness with fever for four months.* Organism probably sulphonamide resistant. Adrenals reported normal in appearance.

Note: The low blood-pressure and fatal collapse suggested suprarenal insufficiency.

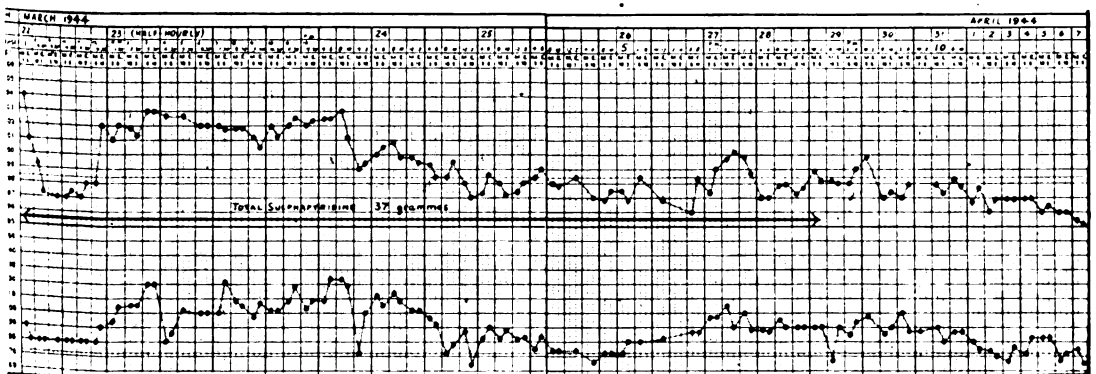
Case 24.—Aged 25. January 26, 1944. There had been a fatal case of cerebrospinal meningitis in same unit, who died in four hours. Early January 26 woke with sore throat, malaise, headache and nausea and later pains in the back. Soon vomiting appeared and then dark blue hæmorrhage spots appeared. Flushed, irritable, myalgia and distressed. T. 99.6. P. 80. R. 20. Herpes labialis and rash now moderately purpuric and extensive. C.N.S. no abnormality. Urine trace of albumen. Throat inflamed but no ulceration. Nil found in other systems. Throat swab showed pneumococci but no meningococci. Blood culture (4), one culture gave heavy growth of meningococci. C.S.F. no increased pressure—opalescent; culture gave meningococci (N.B. no abnormal neurological signs). Sulphapyridine given orally and I.M. 6 grammes and 2 grammes respectively in first eight hours. January 27: No change in condition. W.B.C. 24,250. Polys. 94 per cent. B.P. 100/60. Changed to sulphathiazole. January 29: Improved. B.P.

100/60. No abnormal signs in C.N.S. January 30: Rash fading. Complained of pain in L. knee and both hands. February 1: Leucocytes 9,700. Polys. 72. February 3: Purpuric rash gone. T. 99.2. Feels well. Convalescent and up on February 17. Total dosage of sulphonamide not stated. This case, as did Cases 20 to 22, shows that the *meninges can be involved without giving very definite physical signs except headache and malaise.*

Case 25.—Aged 27. February 7, 1944. Three weeks before admission pain and stiffness in legs, aches all over, did not improve February 7: T. 98.6. Sweating, weakness of L. grip, red spots on hands, arms and legs. E.S.R. 86 mm. Leucocytes 12,150. Polys. 62. February 10: Small effusion R. knee—febrile for two days. February 23: Effusion subsided, aches continue. Sod. sal. 30 grains six-hourly. E.S.R. 104. Seen by Command Physician. February 25: Evening temperature 101.2. February 26: Evening temperature 100. Leucocytes 8,700. Polys. 62. Urine normal. February 29: Spots now disappeared. March 1: Blood culture gave pure growth meningococci. Sulphathiazole. March 3: Afebrile since sulphonamide. ? rheumatic nodes on legs. March 8: Blotchy erythema face, legs, arms. March 12: Blood culture sterile. Rash fading. W.B.C. 5,200. Polys. 49. Steady improvement. Convalescent hospital—to duty April 26. Admitted as a case of rheumatism but no response to salicylates and temperature remained irregular and swinging.

Case 26.—Aged 21. March 22, 1944. Evening March 21 complained of headache and vomited. Admitted to C.R.S. T. 99.2, slight neck stiffness. Admitted to hospital 3 p.m. T. 104. P. 90. R. 25 in coma, could not be roused, restless movements continuous, cyanosed, pulse feeble. Lungs clear. Heart normal, no neck rigidity, no Kernig, plantars flexor. No rash. March 22: L.P. Turbid fluid under pressure; smear showed polymorphs in abundance with intracellular Gram-negative diplococci; cells 5,700/c.mm. Protein 400 mgm. Culture = pure growth meningococci, very ill. Sulphapyridine I.V., I.M. and also by I.V. drip. March 23: Very irritable. T. 102-103 maintained with little variation. March 23 and March 24 with corresponding increase in pulse-rate. Takes fluids well. L.P. March 23 sterile. W.B.C. 28,800. Polys. 85 per cent. Total sulphapyridine to end of March 23 = 14 grammes. March 24: Drug continued I.V. and by mouth. Can speak a little, headache, drowsy. T. falling 99.8. P. 98. March 25: Much better, talking sensibly, very cyanosed, still incontinent. On March 26: Total sulphapyridine 29 grammes. Leucocytes 10,400. Polys. 81 per cent. March 28: Total sulphapyridine 34 grammes. L.P., C.S.F. now clear, cells 35/c.mm. Total drug = 37 grammes. Slight headache only. Convalescence uneventful and no complication. Discharged April 11. No report of neurological examination.

Note: A very rapid and severe case with no meningococcal rash. Very little neck rigidity. Seen later during convalescence. No abnormal neurological signs. Returned to duty.



CASE 26.

Case 27.—Aged 29. May 3, 1944. May 1: Complained of headache, shivering and sweating. May 2: Admitted to sick bay with provisional *diagnosis of malaria* (recently returned from W. Africa). May 3: Headache severe. L.P. turbid with positive pressure. T. 101. P. 84. R. 18. Delirious, restless, body flexed, photophobia, neck extended and rigid. C.S.F. many pus cells. Gram-negative diplococci present in large numbers. Sulphapyridine I.M. followed by sulphadiazine. May 4: Improving. Total sulphonamide 43 grammes. May 12: *R 7th palsy, no involvement of 6th or 8th cranial.* May 28: Recovery complete.

Note: No trace of facial palsy.

Case 28.—Aged ? June 26, 1944. June 8: Reported to unit M.O. for joint pains following a sore throat. T. 100. June 10: Swelling L. elbow-joint. T. 101.4. Sodium salicylate no effect. June 13: Angioneurotic oedema and urticaria, regarded as acute rheumatism. Admitted hospital June 17. Rash fading, no fever, vague pains and malaise. June 21: T. 100 transferred to another hospital. Urticarial wheals on limbs and trunk but also petechiæ on R. arm and trunk. These appear as red spots, the centre of which becomes black. Heart, lungs, abdomen nil abnormal. *Meningococcal septicæmia suspected.* E.S.R. 37. Blood culture negative. W.B.C. 13,000. Polys. 78 per cent. E.S.R. 37. July 10: Pyrexia since admission and temperature rises to 101 every second evening, with each rise petechiæ appear. July 10: Sulphadiazine commenced—total 30 grammes over six days. Immediate response and rapidly got well and discharged to duty August 21.

Note: *A characteristic picture of meningo-septicæmia, with fever suggestive of subtertian malaria with negative blood culture—rapid cure by sulphonamides.*

Case 29.—Aged 18½. June 2, 1945. June 6: General malaise, restlessness and insomnia, headache and vomiting. Flushed, drowsy, photophobic, restless. Pupils equal. small and sluggish to light. Reflexes all brisk, Plantars flexor, Kernig present. Petechial hæmorrhages. Neck rigid. L.P. turbid, pressure increased. Polymorphs but no organisms seen. Sulphapyridine started June 2. June 3: Weakness L. external rectus of eye. June 6: W.B.C. 14,000. Polys. 82 per cent. June 21: No paralysis of eye muscles. Discharged for convalescence July 5. A straightforward case of C.S. meningitis, unproved bacteriologically — response to sulphonamides immediate. Total sulphonamides 38 grammes (693 two grammes; 760 thirty-six grammes).

Note: *Transient 6th nerve palsy.*

Case 30.—Aged 25. June 6, 1945. Admitted C.R.S. June 4 with severe frontal headache. Pains in neck, back and knees, T. 103.6. June 5: vomited, T. 100.7. On admission to hospital June 6 was stuporose, delayed responses, perseveration, photophobic, irritable. restless. No rash. Pupils small, react sluggishly. Reflexes present and equal. Kernig positive. L.P. turbid fluid under pressure. Polys. 16,200. Smear showed intra and extra-cellular Gram-negative diplococci. W.B.C. 23,600. Polys. 89. Sulphathiazole started. June 21: Developed L. facial palsy (6th, 8th and other cranial nerves normal) which gradually subsided and finally disappeared. Discharged to convalescence on July 3. Total sulphathiazole 38 grammes.

Note: *Transient 7th nerve palsy.*

AN ANALYSIS OF 100 CONSECUTIVE OPERATIONS ON THE KNEE AND A REPORT ON A XANTHOMA OF THE KNEE-JOINT.

BY

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[Received November 25, 1946.]

A ROUTINE analysis of 100 consecutive cold operations on the knee performed in this hospital shows some unusual lesions.

In the period January 1 to October 26, 1946, 100 operations on the knee were performed as follows:—

TABLE I.

89 cartilages were removed for the following conditions:—

	<i>Medial meniscus</i>	<i>Lateral meniscus</i>
Bucket handle tear	29	7
Longitudinal tear limited to posterior one-third	12	3
Longitudinal tear limited to anterior one-third	5	1
Peripheral tear	9	3
Incomplete transverse tear on the concave inner edge (so-called parrot beak tear)	8	2
Xanthoma of synovial membrane	1	—
Apparently normal menisci	4	1
Cyst of the menisci	1	4
Total	69	21 = 90

TABLE II.

Analysis of Table I.

Meniscectomy for pre-operative diagnosis of torn meniscus	84
Torn menisci removed	78
Other conditions found—xanthoma	1
Apparently normal menisci removed	5

TABLE III.

(1) Removal of loose bodies	7
(2) Arthrotomy for loose body.	
Loose body not found	1
(3) Removal of Michel clips from the knee	1
(4) Removal of calcified plaque from the capsule of the knee-joint	1
	10

Grand total 100.

TORN MENISCI.

The figures are small and there is nothing unusual about them. However, 5 normal menisci were removed for a pre-operative diagnosis of torn meniscus in 84 cases (5.5 per cent).

The difficulty has been to determine which cartilage is torn and not whether a cartilage is torn. Thus two patients had both cartilages removed. In one patient a normal-looking medial meniscus was removed. On inspecting the lateral meniscus a bucket handle torn meniscus was seen and the lateral meniscus was removed at the same session by a separate incision. In another, a normal-looking medial meniscus was removed in January. Symptoms persisted and in the presence of a very atrophic quadriceps and a torn cruciate ligament signs of a torn lateral meniscus were found and in June a bucket handle torn cartilage was removed. The patient remained with us at the time of writing. He had a persistent effusion—little quadriceps and refuses to work at this muscle.

The remaining three were men whose symptoms and signs appeared to be relieved after operation. We keep our meniscectomy cases in hospital under a P.T. instructor until such time as we think they can undergo a battle course. This takes on the average eight weeks after operation. They are then sent to a convalescent depot for final rehabilitation and any cases that do not do well are returned to us. None of the meniscectomies including these three have been returned to hospital. Nevertheless three normal-looking and firmly attached medial menisci were removed. These three might easily turn out to be torn lateral menisci.

In two patients two menisci were removed at one session:

(a) An officer from whose other knee both cartilages had previously been removed. At operation in the affected knee a peripheral tear of the lateral meniscus was found but on inspecting the medial meniscus a bucket handle tear was also found.

(b) An O.R. whose physical signs indicated a discoid cartilage of both medial menisci. From each joint an enlarged (but not a complete discoid cartilage) medial meniscus was removed at the same session with complete relief of symptoms and signs.

The number of incomplete transverse tears is higher than usual. One lesion was a complete transverse tear reunited by fibrous tissue which itself was recently incompletely torn, and it was this recent tear which was the cause of his immediate pre-operative lockings.

In one of the posterior horn tears, the medial meniscus had previously been removed but symptoms persisted and the signs pointed to a tear of the posterior horn. At operation the fibrous tissue regenerated cartilage was removed in the anterior two-thirds, but the posterior one-third of the meniscus had not been removed at the previous operation and when removed showed a longitudinal split on its inferior surface.

We have often been struck at operation with the appearance of softening, of fibrillation and of atrophy of a circular area of the lateral surface of the medial condyle of the femur where this surface has repeatedly rubbed over the

bucket handle tear of a medial meniscus during the roll and the glide of the femoral condyle on the tibia in flexion and extension. This pathology does not show up in the X-ray. One knee showed this appearance in all the articular cartilage of the tibia and the femur and patella available for inspection through an incision for removal of a double bucket handle tear of the medial meniscus. The X-ray appearances appeared within normal limits. It did not look quite right. Weight-bearing and non-weight-bearing surfaces appeared to be involved. It did not look like osteo-arthritis. An immediate Kahn was taken and came back strongly positive. Unfortunately the cartilage specimen was discarded.

Demobilization presented us with four bad knees. These were men who had had repeated mechanical locking of the knee and who were anxious to have the knee attended to before returning to civilian life. Previously an attending surgeon had declined to operate and had downgraded the men. Two patients had severe osteo-arthritis of the knee and two more had a complete tear of the anterior cruciate (confirmed at operation) and an incomplete tear of the medial collateral ligament. In all four a torn medial meniscus was excised. We were surprised at the immediate good results obtained before being transferred to the convalescent depot.

Air arthrography of the knee-joint was used once only. Here the symptoms were that of mechanical locking but the only physical sign in the presence of quadriceps wasting was a clunk heard in full flexion when the tibia was rotated on the femur. But we could not be definite on which side the clunk was palpable. Further the straight X-ray showed a possible loose body in the joint (fig. 1).



FIG. 1.—Straight X-ray shows ? sesamoid bone ? loose body in the posterior and medial compartment of the knee-joint.

The air arthrogram after the technique of Somerville shows, however, the so-called loose body to be outside the joint (fig. 2) and in the A.P. view (fig. 3) a bucket-handle tear of the lateral meniscus is demonstrated, with the displaced handle towards the intercondylar notch and the femoral condyle resting between the tapering edges of the tear.

At operation a double bucket-handle torn lateral meniscus was removed, the inner portion suffering a secondary bucket-handle tear.

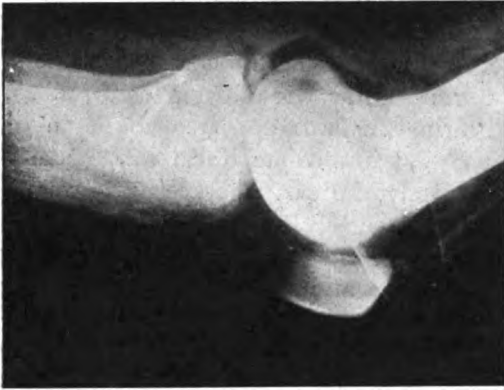


FIG. 2.

FIG. 2.—Shows that the ? loose body is a sesamoid bone which is outside the capsule distended by air (air arthrogram).



FIG. 3.

FIG. 3.—Bucket handle tear of lateral meniscus with handle displaced towards the intercondylar notch and the femoral condyle lying between the thin tapering edges of the tear (air arthrogram).

This specimen is now in the Surgical Museum at R.A.M.C. College, Millbank.

CYSTS OF THE MENISCUS.

The cyst of the medial meniscus was the largest cyst we have encountered. It was one and a half inches in diameter situated anterior to the medial collateral ligament in the joint line.

Operation showed the cyst to be circumscribed and lying extracapsular. It could be readily dissected from the capsule except where a definite stalk-like process appeared to run between capsular fibres and become continuous with the meniscus which itself showed definite evidence of cystic degeneration.

It appeared as if the cyst had been able to penetrate the capsular fibres, and having done so any increase in cyst content became extracapsular.

This officer patient was demobilised and very anxious to return to his civil life. The financial reward gained by his early return to his job was responsible for an excellent quadriceps and full movements in a dry joint at the end of three weeks.

We have been on the look out for bursa of the collateral ligaments which Voshell and Brantigan and Henderson state in the past have been confused with cysts of the menisci but so far our pre-operative diagnosis of meniscal cysts have been confirmed at operation and we have not found these bursal enlargements.

XANTHOMA OF THE KNEE-JOINT.

The xanthoma of the knee-joint was not diagnosed pre-operatively—nor were any of the published cases whose total number is 40 (De Santo and Wilson

39 cases (1939) and O'Donohue one case 1942). And yet the pre-operative diagnosis might have been suggested if the lesion had been thought of.

Here was a young man suffering from repeated locking. Every time his knee locked he could feel a mass. If he pushed the mass back the locked knee was immediately reduced. There was no mass between lockings and no mass was felt on physical examination. X-ray showed no loose body.

Case history.—Pte. D., aged 19, had no trouble with his knee until eight months ago when he caught his left foot in a rabbit hole and fell with the knee flexed whilst the tibia was adducted and externally rotated on the femur. A swelling immediately appeared on the inner side of the knee and he suffered acute pain. He could not straighten the knee. He sat down massaging the knee and after an hour the lump went back and he could move the knee freely. There was no subsequent effusion and he did not report sick. Since then the knee has locked on one occasion and was irreducible for an hour but on 20 to 30 occasions the lump has appeared with momentary locking, but the patient has been able to replace the lump immediately and thus unlock the knee.

The lump comes out when the knee is extended but very rarely in flexion. The lump always appears at the same site which is midway between the tibial collateral and the patella ligaments.

On examination the general health was good and the right knee was normal.

Left knee presented no scars, no fluid with quadriceps power and girth equal to right side. Extension and flexion were full. Cruciates and fibular collateral ligaments were sound. The internal lateral ligament was a little lax.

McMurray's sign did not give a definite click but gave the impression of something moving on the inner side of the joint.

March 26, 1946: Examination under an anæsthetic gave a cartilage "clunk" on full flexion felt over the medial meniscus. X-ray no abnormality detected. In view of the repeated and definite history of real mechanical locking and under anæsthesia the presence of a cartilage "clunk" obtainable on rotation of the tibia on the femur felt on the medial side of the knee-joint a diagnosis of torn medial meniscus? with cystic degeneration was made.

When the knee-joint was opened by a vertical incision on the medial side, a tumour mass at once presented. It was a solid, pinkish, lobulated rounded mass one inch in diameter attached by definite narrow stalk leading to hypertrophied thickened synovial membrane, which in turn was attached to the periphery of the cartilage and to the hypertrophied infrapatellar pad of fat.

The anterior horn of the medial meniscus was completely detached from its anterior attachment and lying free towards the intercondylar notch. The periphery of the meniscus was firmly attached and showed no other tears or evidence of bruising.

The pedunculated tumour lay in the intercondylar notch, was freely mobile and could easily move between the medial condyles of the tibia-femur to cause locking. Its free extremity showed bruising. The pedicle was attached to the synovial reflection in the vicinity of the free anterior horn of the medial meniscus. There was no fluid in the joint.

The pedicle was ligated and an attempt made to remove the tumour, the hypertrophied synovial membrane over the infrapatellar pad of fat and the medial meniscus in one piece, but during traction on the cartilage, whilst delivering its posterior third, the pedicle of the tumour became separated.

After total meniscectomy and removal of the tumour the joint was closed in layers.

Fig. 4 shows the tumour with its ligated pedicle attached to the fold of the excised synovial membrane which has been turned over and thus covers the free concave border of the excised cartilage. This large veil of synovial membrane included the excised thickened infrapatellar pad of fat.

Major Raeburn, R.A.M.C., lately pathologist to this hospital, states that "the tumour is a giant-cell xanthoma of the synovial membrane but that benign histiocytoma is probably a better name as this fits in with the modern classification of the reticulo-endothelioses."



FIG. 4.—Photograph of a xanthoma of the knee-joint with the excised meniscus and synovial membrane.

LOOSE BODIES OF THE KNEE-JOINT.

We were not able to establish the origin of the loose body in any of the seven cases although we have looked for osteochondritis dissecans in the femoral condyle in the tibial plateau and in the patella. Nor could we find evidence of their origin from a torn meniscus.

The wandering of these joint mice is well shown by the following case history:—

Gdsm. B., aged 18. Three months ago he fell and injured his right knee, which rapidly became swollen. He was in hospital for twelve days.

Since then he states that he has repeatedly felt a lump moving about the joint. The knee has never actually locked but on a number of occasions the lump has become engaged between the bones and had to be disengaged.

On examination the right knee shows no fluid. All ligaments are stable. Quadriceps good. No McMurray sign obtained. Following manipulation by the patient the loose body could be felt in the suprapatellar pouch—hypermobile and seemed to be bean-shaped and about 1 inch in diameter.

X-ray shows a normal knee-joint save for uniform ovoid shadow 1 cm. in long diameter, lying posteriorly in joint, in intercondylar notch. This was considered to be the shadow of the palpable loose body. A stippled shadow, 1.5 cm. long and 0.5 cm. thick, lying above the patella, was noted but not considered to be the shadow of the loose body (fig. 5).

On account of the patient's statement that he could produce the loose body at any time, the knee was prepared for three days and operation planned for the morning of September 3, 1946.

On this morning the loose body could not be felt or found by the patient. He was consequently not taken to the theatre.

At 8 p.m. that evening the patient said he could feel it. A sterile needle and local

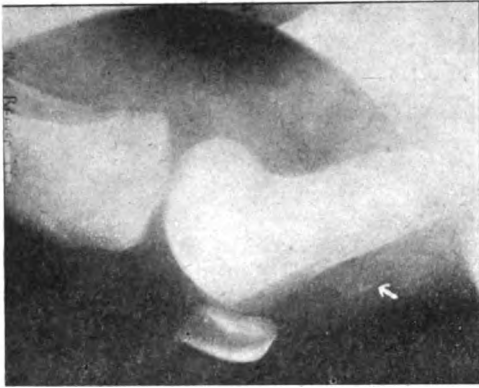


FIG. 5.—Lateral view of the knee showing (a) elongated stippled shadow in the suprapatellar pouch and (b) sesamoid bone in posterior compartment of the knee. It is partly obscured by the femoral condyle.

anæsthetic were speedily brought, the loose body identified over the medial femoral condyle and impaled with the needle.

He was then taken to the theatre and anæsthetized. The Esmarch was applied with every care. However, on incision down on to the needle, the loose body was not found. Repeated manipulations were unsuccessful. A portable X-ray was then taken and it was realized that the stippled shadow, lying in the suprapatellar pouch, was in fact the shadow of the loose body.

Further palpation showed the loose body was again palpable above the patella. A rapid direct incision was made on to the loose body which was held and steadied between two fingers and then recovered. It was cartilaginous, 1.5 cm. in diameter and about 0.5 cm. thick.

In one patient a small loose body in the anterior lateral compartment could not be found. Six months later the man was invalided out of the Service with osteo-arthritis of the knee.

The retained Michel clip in the knee was in a patient whose medial meniscus was removed in a military hospital in India in 1945.

His post-operative phase was slow and X-ray showed a Michel clip to be retained in the knee. He was invalided home for its removal. For this purpose an arthrotomy through a wide exposure was performed in April, 1946, but the clip was not found. When the wound was healed he was transferred to this hospital. Straight X-ray showed the clip to be in the vicinity of the knee-joint probably outside the capsule (fig. 6). His disability was limitation of flexion to 80 degrees, quadriceps wasting and the knowledge that the clip was still in the joint.

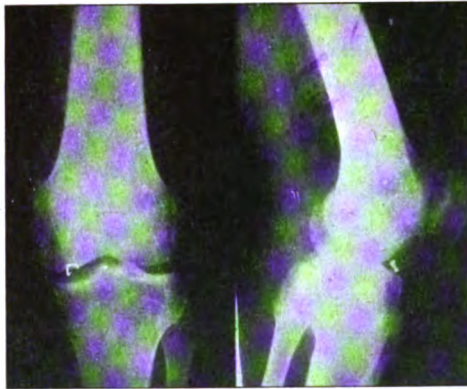


FIG. 6.—A.P. and lateral views of a Michel clip possibly in the knee-joint.

By X-ray localization using needles inserted under local anæsthetic at right angles to each other the clip was removed by a minute incision made on to the foreign body which was found to lie on the capsule (figs. 7 and 8).

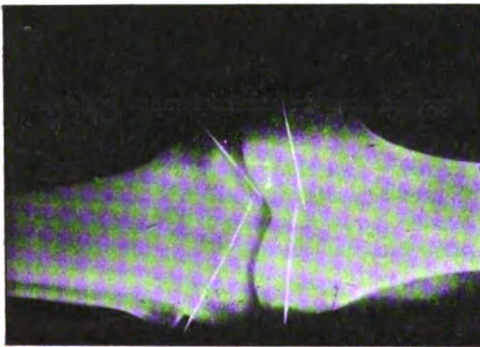


FIG. 7.



FIG. 8.

FIGS. 7 and 8.—A.P. and lateral views of the clip localized by two needles inserted under local anæsthetic at right angles to each other.

He was discharged two months later with full knee movements and good quadriceps.

Since this event we have made it a theatre rule that the theatre Sister gives an "all correct" account of the Michel clips used, in the same way that swabs are accounted for in abdominal operations.

A calcified plaque was removed from the anterior joint capsule of the medial compartment of the knee from a man whose cartilage had been removed three and a half years previously.

His complaint was instability of the knee with limitation of full flexion. His physical signs were wasting of the quadriceps, incomplete full extension and flexion limited to 20 degrees beyond a right angle. A small mass could be felt beneath the meniscectomy scar corresponding to the X-ray shadow of a ? loose body in the medial and anterior compartment of the knee-joint (fig. 9).

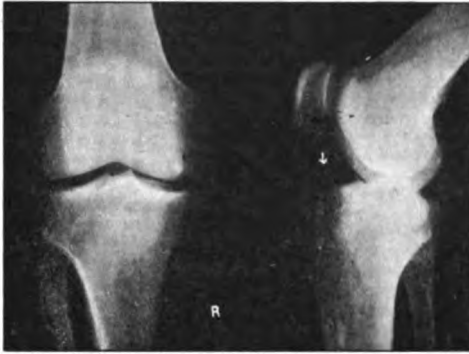


FIG. 9.—A.P. and lateral views of a calcified plaque in the line of the joint capsule.

By a small incision this palpable calcified mass $\frac{1}{2}$ inch in diameter was removed from the joint capsule without opening the joint and with subsequent full recovery of knee movements.

SUMMARY.

(1) No attempt has been made to follow up these cases. We are only recording the operative findings from the operation book (A.B.485) during a routine analysis of the last 100 knees operated on at the Q.A. Military Hospital, Horley.

(2) I wish to thank Colonel A. R. Oram, O.B.E., M.C., Officer Commanding this hospital, for permission to publish these facts.

(3) The forty-first case of xanthoma of the synovial membrane of the knee-joint is added to this literature.

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SOME ASPECTS OF PNEUMONIA AMONG AFRICAN TROOPS IN THE GOLD COAST AND THE RESPONSE OF THIS DISEASE TO SULPHAMERAZINE.

BY

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THE following observations were made in a military hospital during the first six months of 1946. Pneumonia during this period accounted for approximately one-fourth of all admissions to the Medical Division. Most of the cases occurred among African repatriates from the Far East, since of the 89 cases studied here, 73 were repatriates. The diagnosis was confirmed radiologically in all cases and the course of the disease studied clinically and on the X-ray film and screen. Detailed bacteriological and biochemical investigations were unfortunately not practicable. The majority were treated with sulphamerazine, with a small control series on sulphadiazine.

THE CLINICAL PICTURE.

Only true cases of lobar pneumonia are discussed. Four cases of primary atypical pneumonia were seen and are not included.

The patients were young male Africans (average age 20 to 30 years) who showed no evidence of any preceding debilitating illness and for the majority this was their first visit to a hospital.

The clinical types were two: A, the classical type 78 cases; B, the aberrant type 11 cases.

Class A.—Typically the patient gave a history of sudden illness with cough, shivering, fever and pleuritic pain accurately localized. He was febrile, temperature 103° to 104° F., dyspnoëic and able to cough up sputum of a mucopurulent or "rusty" character; the *alæ nasi* were mobile. Clinical examination of the chest showed signs of congestion over one lobe. The later signs of consolidation were rarely seen on admission as the illness was then seldom more than twenty-four hours old. Detection of early middle lobe cases was found more difficult even by listening carefully high into the axilla; indeed it was easier and quicker to establish the diagnosis from the history, especially the location of pain, the general appearance of the patient and the movement of the chest. The response to chemotherapy was significant—the temperature falling to normal in twenty-four hours, with an equally remarkable clinical improvement. Some patients gave a history of a preceding upper respiratory infection, but in only one was a definite bronchitis observed to precede a lobar pneumonia.

Class B.—Here the patient had a pneumonia which showed unusual presenting features and/or clinical course. Of these 11, 4 had an unusual onset presenting as pyrexias of uncertain origin for forty-eight hours before a respiratory

involvement was evident. One of these was associated with meningismus and later proved to be a right upper lobe pneumonia. The remainder were virulent infections (4 of these 7 were bilateral cases) with considerable toxæmia. These showed little or no response to sulphonamide therapy.

The clinical course of both types is summarized as follows: Recovery 88; death 1.

COMPLICATIONS.

Pleurisy, serous	...	...	...	...	3
Empyema	...	...	...	...	Nil
Abscess	...	...	...	...	Nil

The effusions were small and did not significantly prolong the recovery.

LABORATORY INVESTIGATIONS.

These included routine sputa, blood films, full leucocyte counts including differentials and blood culture in the severe cases.

Sputa.—Number of cases examined 87; pneumococci present in 50 (unfortunately typing was not possible); streptococci and staphylococci in 32; *Micrococcus catarrhalis* 5; no acid-fast bacilli found in any case.

Blood culture was done in all severe cases but no case of bacteraemia was detected.

Blood films (thick and thin) were examined routinely in all cases. Malaria parasites (ring forms of *Plasmodium falciparum*) were seen in only one case. The patient was given a complete course of mepacrine (2.7 grammes) concurrently with the sulphonamide, and the progress was not appreciably different from the rest. The microfilaria of *Loa loa* were present in another and here also the course of the disease was not appreciably altered.

The Leucocyte Response.—Number examined 84; total W.B.C. count—10,000 per c.mm., or less, 53; polymorphonuclear leucocytosis in 31 (maximum count 32,600 per c.mm.).

It must be remembered that the majority of Africans have a low leucocyte count with a relative lymphocytosis so that the neutrophil and lymphocyte figures correspond, or are reversed—possibly the response of a system to repeated and varied protozoal infections, though Europeans living in the tropics also tend to show an increase of lymphocytes in the differential leucocyte count apart from protozoal infections. No significant information could be deduced from the results of the differential leucocyte counts.

RADIOLOGICAL INVESTIGATIONS.

Portable films were often not possible on the day of admission but serial screening supplemented by films was practised commencing usually within two days of admission and repeated at two to three day intervals with up to 7 examinations during the period of hospitalization. (The set used was a Watson "Mobilex" and care was taken to keep the kV. and ma. output as constant as possible.) The African is a sturdy patient and tolerates screening better than his European brother.

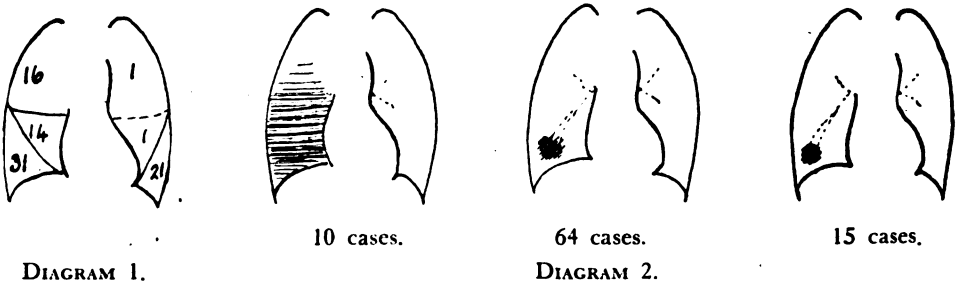
The case-incidence of the disease in the various lobes is indicated in Diagram

1. These figures do not include an additional 5 representing those of bilateral disease.

The predilection for the right lower lobe is notable.

The appearances of the lesions were more interesting but it must be remembered that they represent those seen under the influence of active treatment not the natural history of the disease.

In only ten cases was the typical picture of a massive lobar consolidation seen. The usual picture seen in 64 cases of this series was an irregular opacity usually situated towards the periphery of a lobe. The remaining 15 patients showed a similar picture but here it was a clearly defined rounded focus two to three inches in diameter rather similar to a large Assmann focus (see Diagram 2).



In the case of a middle-lobe involvement or base of upper lobe, the postero-anterior picture sometimes suggested a lesion confluent with the hilum—"a central pneumonia." Lateral positioning showed the process to be situated more peripherally. In no case was an early lesion seen confluent with the hilum. These findings are contrary to those stated by Shanks, Kerley and Twining (1938) who consider that the process commences at the hilum and extends outwards. However they do note that peripheral lesions are often found in children. The situation of the lesions in this series is in accordance with the findings of Loeschcke (1931) who claims to have identified the original focus of infection in 47 cases of lobar pneumonia, and in all these it was near the periphery of the lung, usually in a dorsolateral position. Loeschcke's work (1931) was in accordance with the later experimental work by Terrell, Robertson and Coggeshall (1933) on the pathogenesis of pneumonia which replaced the earlier hypothesis of Blake and Cecil (1920).

Apart from the site of the lesions the most striking feature was their transience; they were very much lesions in time as well as in space. Even after forty-eight hours a definite change in the form of a decreasing shadow was noticeable. This change coincided with the clinical improvement of the patient and by the time chemotherapy was complete the lesion in the average case was fast disappearing. It is appreciated that the picture seen was only a shadow but its close correspondence with the clinical condition was notable. In all the cases that shadow had disappeared leaving only some increase in the vascular pattern by the time the patient left the hospital. The average stay in

hospital was thirteen days; the minimum period seven and the maximum thirty days.

Unfortunately no correlation between the character of the lesion and the serological type of pneumococcus was possible.

EFFECTS OF TREATMENT.

The details of treatment were as follows: Number of cases treated, 89; sulphamerazine only, 68; sulphamerazine and penicillin, 6; sulphadiazine only, 14; sulphadiazine and penicillin, 1.

Sulphamerazine is 2 (p-Aminobenzenesulphonamide-4-Methylpyrimidine).

This drug is the mono-methyl derivative of sulphadiazine; it is more soluble than the latter and less likely to cause urinary obstruction. When given by the mouth it is rapidly absorbed and slowly excreted so that it gives a higher and more persistent blood level than any other sulphonamide in the same dosage.

The drug was given four-hourly commencing with 4 grammes, then 2 grammes, 2 grammes and thereafter 1 gramme for a period of four to five days, giving an average total of 30 grammes. Treatment was continued for an extra day in severe cases. Fluids were given liberally—12 to 15 pints per twenty-four hours. This dosage is heavy and though no blood estimations were assayed, the blood level of sulphamerazine was presumably in the region of 12 to 16 mgm. per cent during the five days. This was the figure determined by Genecin *et al.* (1945) in their series treated with maximal doses. As a rule no opium preparation was given though an occasional exception was made for the early distressed case. Careful nursing was stressed and the patient disturbed as little as possible for screening. The response to treatment was satisfactory—crisis occurred in twenty-four to forty-eight hours and convalescence was rapid and uneventful. An expectorant mixture was often beneficial after completion of chemotherapy.

Toxic symptoms with sulphamerazine were minimal and less than those seen with sulphadiazine. Occasional nausea was noted, but vomiting was seen in only one case. Marked cyanosis was not observed. There was no case of oliguria or evidence of renal damage. Drug fever was seen in only one case.

Of 68 cases treated with sulphamerazine, 62 resolved completely with an average stay in hospital of twelve days.

In the control series of 15, 14 cases resolved completely with sulphadiazine with an average stay in hospital of sixteen days.

Thus 6 cases failed to respond to sulphamerazine but did so dramatically (this word is chosen with care) when transferred to penicillin. The cause of this failure was not obvious apart from the fact that the pneumonias were all severe (4 of them were bilateral).

The following is illustrative:—

Pte. K. M., aged 28, was admitted to hospital one week after disembarkation from India, with bilateral pneumonia. The temperature was 103°F., the sputum "rusty" and contained numerous pneumococci, W.B.C. 16,800 per c.mm. with 90 per cent neutrophils, 10 per cent lymphocytes, 0 per cent eosinophils, 0 per cent monocytes and 0 per cent

basophils. The patient was started on routine sulphamerazine and this continued for six days (total 32 grammes). There was little improvement and the temperature continued 101° to 103° F. Treatment was changed to penicillin 50,000 units immediately then 15,000 units three-hourly to a total of 410,000 Oxford units. The crisis occurred in twenty-four hours and convalescence thereafter was rapid and progressive. X-ray appearances of chest (see Diagram 3).

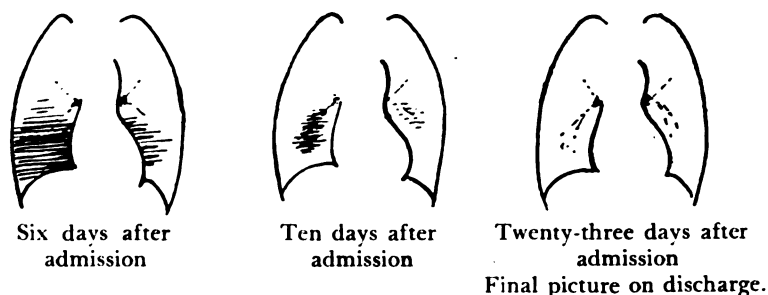


DIAGRAM 3.

Whenever possible Clinical and X-ray examination were repeated one month after discharge from hospital. No relapse nor evidence of delayed resolution was noted.

EPIDEMIOLOGY.

An interesting feature of this series is the occurrence of a relatively large number of cases among healthy young Africans living under crowded conditions. The incidence among repatriates from India was nearly four times that among local units. Also during this time there was no case of pneumonia among European troops, where accommodation was better.

The determining factors are obviously: (1) The virulence of the organism; (2) the susceptibility of the individual. Both are problems difficult to elucidate in detail, especially the latter. The influence of environment would seem important, and certainly the effects of crowding and climate.

Several medical officers on troopships noted that the incidence of pneumonia was much lower in the early stages of the voyage from India to West Africa, even though there was a fairly sudden change from hot to cool climate when passing through the Suez Canal. The incidence of the disease was greatest during the last three to four days of the voyage and during the first four days in the transit camps where crowding was also inevitable. Crowding and close contact continued over a period (in this instance about three weeks) appears a definite predisposing factor.

Close quarters appears to be the most important factor in causing a rise in pneumonia incidence in Africans. Outbreaks of pneumonia have in fact followed short voyages in troopships, as for instance from the Gambia to the Gold Coast, while any temporary overcrowding, occurring in training camps, has invariably resulted in a rise in the pneumonia rate. This increase in pneumonia in Africans occurs not only with recruits but with soldiers who have had three to four years Army life. (Personal communication from Brigadier Findlay.)

Climate also plays its role, though a minor one; that of the Gold Coast is

warm (shade 85° F.) and humid (relative humidity 75 per cent to 80 per cent), with little seasonal variation. This combination appears to lower the resistance of epithelial tissue to infection—the relatively greater incidence and chronicity of respiratory and skin conditions is well known to medical officers on the “Coast.”

Though lobar pneumonia is not usually regarded as an infectious disease its infectivity is very definitely seen here, and though there was no cross-infection among patients, one nursing orderly went down with a severe attack. It would seem advisable to re-emphasize the infectiousness of this disease. Price (1941) recommends that no case of pneumonia should be nursed in a general ward of a hospital and the *doctor and nurse in attendance should wear gauze masks*.

Incidentally only one case of meningococcal meningitis was admitted to hospital during this period.

CONCLUSIONS.

(1) The very definite infectivity of lobar pneumonia in Africans is again noted.

(2) The radiological appearances in treated lobar pneumonia suggest lesions much smaller than usually described, and further that these lesions are very short lived.

(3) Sulphamerazine is an eminently suitable drug for the treatment of lobar pneumonia in Africans and is rather better than sulphadiazine in the tropics. Both are very definitely inferior to penicillin which is certainly the choice for acute fulminating cases.

I wish to thank Brigadier G. W. M. Findlay, C.B.E., recent consultant physician in Tropical Medicine West African Command for his considerable help and criticism.

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Clinical and Other Notes.

PURULENT PERICARDITIS—COMBINED SURGICAL AND PENICILLIN TREATMENT.

BY

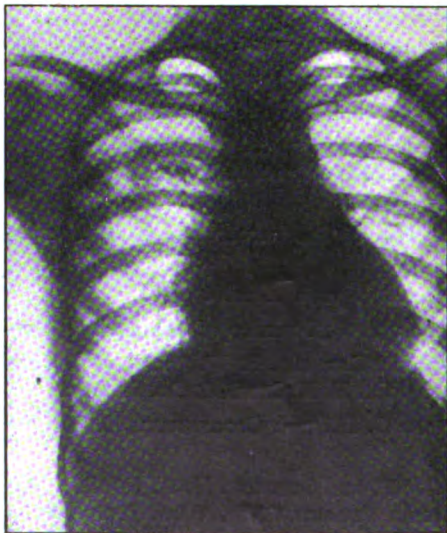
Major C. W. TEMPLETON, I.M.S./I.A.M.C.

DETAILS of a successfully treated case of purulent pericarditis following pneumonia are given as being considered of sufficient clinical interest to warrant publication.

On 28.1.46 an Indian Sepoy aged 22 was admitted to a military hospital with a three-day history of cough, fever and pain in the chest. His previous medical history contained no illness of note and there was nothing relevant in the family history.

On admission patient appeared acutely ill, rather collapsed and showing respiratory distress—T. 98, P. 66, R. 32, B.P. 100/60. There were moist sounds present over a limited area just below the right clavicle and on this a diagnosis of early pneumonic consolidation was made and treatment with sulphathiazole initiated. Blood slide showing no malarial parasites but leucocyte count was 25,000 of which 83 per cent were polymorphs. Sputum—no A.F.B. 30.1.46: General condition of patient had not improved, pulse was rapid and of poor quality. B.P. 100/64. Heart sounds were distant and apex beat no longer palpable. There was definite evidence of small patch of pneumonic consolidation upper lobe right and a pleuropericardial rub was audible at right border of sternum.

X-ray: "Evidence of a circular patch of consolidation in the right subclavicular region. Heart shadow is triangular in shape and appears to be enlarged in all directions suggestive of pericardial effusion" (Skiagram 1).

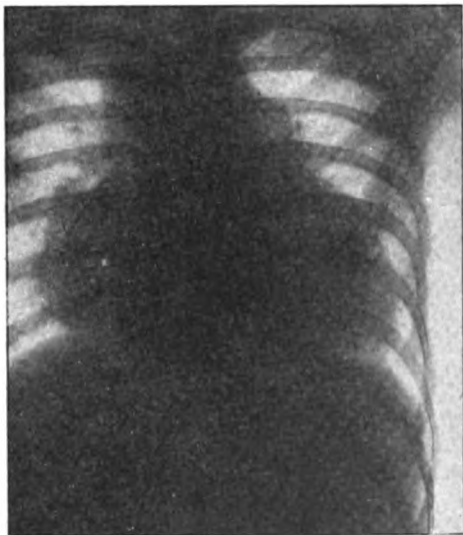


SKIAGRAM 1 (30.1.46).—Pneumonic consolidation upper lobe right—early pericardial effusion.

Sulphathiazole was continued and intramuscular penicillin 15,000 units three-hourly commenced.

7.2.46: There had been a steady deterioration noted in general condition and pulse was now of low tension and irregular. Area of cardiac dullness greatly increased—transverse diameter 9 inches. Heart sounds were almost inaudible and irregular in force and rhythm. To date penicillin 840,000 units and sulphathiazole 52 grammes had been given.

X-ray: "Satisfactory resolution pneumonic patch right upper lobe—gross pericardial effusion" (Skiagram 2).



SKIAGRAM 2 (7.2.46).—Satisfactory resolution pneumonic patch—massive pericardial effusion (before aspiration).*

8.2.46: Aspiration left border sternum 5th intercostal space—24 ounces of purulent fluid withdrawn and 60,000 units of penicillin injected into pericardial sac. Penicillin 12,500 units three-hourly continued by intramuscular route. The pericardial fluid showed large numbers of pus cells and blood corpuscles but no organisms were demonstrated on smear or culture.

Leucocyte count was now 37,000 with 84 per cent polymorphs.

12.2.46: No improvement in general condition and no reduction in area of cardiac dullness while heart sounds remained irregular and very distant. B.P. 112/62. Pericardial sac again aspirated and on this occasion 18 ounces of blood-stained fluid were withdrawn while a further 100,000 units of penicillin were injected.

Laboratory Report.—Cytology—degenerative pus cells predominate. Gram's stain—no micro-organisms seen. Culture sterile.

14.2.46: In view of the gross effusion and cardiac embarrassment pericardial incision and drainage was decided upon—Major L. J. Temple, R.A.M.C. Under local block with gas and oxygen incision was made $1\frac{1}{2}$ inches from and parallel to mid-sternum. Costal cartilages of ribs 5 and 6 resected and good exposure obtained. On opening pericardium sanguineous fluid under marked tension spurted out to a height of 4 feet above the table. The heart was noted to be coated with a fibrinous deposit. Pericardial edges were sutured to skin and a small tube fixed to lie just inside the pericardium. Penicillin

100,000 units were injected into the pericardium and 10,000 units four-hourly to follow—the intramuscular injections being continued.

Patient stood operation well—by the next day more comfortable. For the following five days tube continued to discharge a sanguineous fluid in decreasing quantity. On 19.2.46 tube was removed and penicillin stopped—quantity given 260,000 units directly into pericardium 360,000 by tube and a total of 1,640,000 by intramuscular route.

Temperature was then fluctuating around 99-100 and pulse was now of better quality and regular though still rapid 100-120. Heart sounds were pure and B.P. 108/68. A thin blood-tinged discharge continued from the chest wound which otherwise was satisfactory.

4.3.46: Still running low-grade temperature but general condition greatly improved. R.B.C. 4,400,000 per c.mm.; Hb. 80 per cent; W.B.C. 9,600 per c.mm.; P. 70; L. 28; E. 2. Heart sounds regular but soft. B.P. 94/64.

10.3.46: Clinical evidence of left pleural effusion.

15.3.46 (X-ray chest): "Evidence of effusion left pleural sac with heart shadow displaced to the right" (Skiagram 3).



SKIAGRAM 3 (15.3.46).—One month after operation. Extensive pleural effusion with mediastinal shift to right.

Fluid aspirated from left chest—blood tinged, few epithelial cells and lymphocytes, no organisms demonstrated on smear or culture. Culture for A.F.B. negative.

22.3.46: From left pleural cavity 45 ounces of straw-coloured fluid aspirated. Course of sulphathiazole commenced. Thereafter progress was uneventful—the chest wound finally healed on 4.4.46—seven weeks after operation. The residual effusion left pleura was slow to absorb but no further accident occurred and by 20.5.46 patient was allowed up.

24.6.46: Patient afebrile and with no complaint apart from an awareness of cardiac pulsation. Up and walking slowly around the ward with a steady pulse rate of 70 to 80 per minute. The chest wound was slightly retracted but soundly healed and the scar painless. Heart sounds were of good quality and pure B.P. 106/68. There was no clinical evidence of residual pleuropulmonary mischief.

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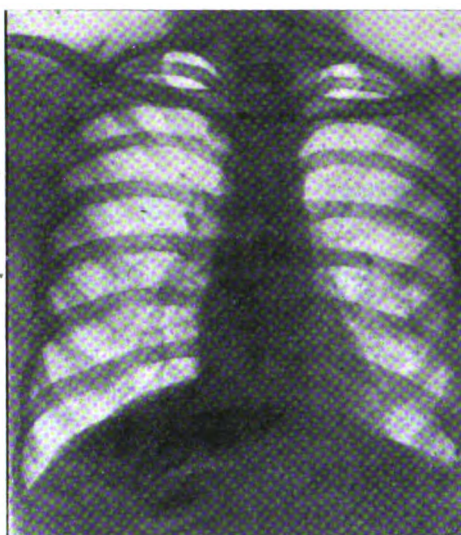
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X-ray: "Cardiac shadow is now within normal limits and lung fields are clear" (Skiagram 4).



SKIAGRAM 4 (24.6.46).—Complete absorption pleural and pericardial effusion.

The features of this case therefore were a right subclavicular pneumonia which was quickly followed or perhaps accompanied by a pericarditis with effusion. The organism though not proved being almost certainly pneumococcus. Penicillin presumably had the effect of rendering the effusion sterile though it did not prevent the accumulation of further fluid.

Drainage was successfully carried out—drainage tube being removed after five days though wound did not heal for seven weeks. Five weeks after operation a left pleural effusion appeared—origin of this delayed onset is not obvious.

Ultimate functional recovery after six months has been good though there remains the danger of the development of an adhesive pericarditis.

My thanks are due to Major L. J. Temple, R.A.M.C., who carried out the operation and post-operative treatment and to Captain K. K. Nayak, I.M.S., in whose care the case originally was, to Major A. Wahid, I.M.S., for Radiology and to Lieut.-Colonel H. M. Salamat, Ullah, M.C., I.M.S. for permission to publish the case.

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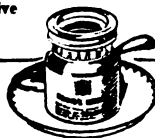
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Journal of the Royal Army Medical Corps.

Original Communications.

THE TOXIC EFFECTS OF TEN DAILY INJECTIONS OF MAPHARSIDE COMBINED WITH PENICILLIN IN THE TREATMENT OF EARLY SYPHILIS.

BY

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Royal Army Medical Corps.

Lately Advisor in Venereology to the War Office.

[Received March 16, 1947.]

IN January, 1946, as the results of the treatment of early syphilis by means of 2·4 million units of commercial penicillin over seven and a half days were not as good as had been anticipated from first experiences, it was decided to place the treatment of the Army at home on an experimental basis and to increase the amounts of spirochætocidal substances given.

Approximately one-half of the patients were then treated with four million units of commercial penicillin in aqueous solution administered in one hundred three-hourly injections of 40,000 units. The remainder were given a combined penicillin and arsenic schedule which, in its experimental trials using neohalarsine or mapharside, had been found by Marshall to show promising results [4]. This consisted of 2·4 million units of penicillin, given in sixty three-hourly injections, with ten daily intravenous injections of 0·06 gm. mapharside. This latter amount was thought, from previous experience in the intensive field, unlikely to have the disadvantage of excessive toxicity and at the same time to comprise a more efficient, but still rapid, treatment for early syphilis.

It was decided to treat 1,000 cases on each of these two schedules, while another hospital employing 2·4 million units of penicillin, as before, plus 400 mg. of mapharside combined with one gm. of bismuth (a rapid treatment schedule commenced by Major Laird) should continue. Before the end of the year, over 1,000 cases had been treated by each of the three schedules and the experiment was concluded. It was planned that the analysis of the results would take place through the Central Syphilis Register at the War Office, though it had been feared that there would be a big fall off in the follow-up as a result of demobilization which was taking place on a grand scale. The work in this respect could be considerably improved if civilian clinics respond to

the Ministry of Health letter asking for particulars of discharged Service men attending civilian clinics to be sent to the Service departments concerned [5].

Preliminary reports as to the results obtained in those patients successfully followed up at individual hospitals were not encouraging [10]. Partly for this reason, and partly owing to the disturbing information concerning the variants in the content of commercial penicillin with the relative ineffectiveness of penicillin K [8], the Army was placed on a safer, if longer, schedule of four million units of penicillin over ten days plus a full course of neoarsphenamine and bismuth over ten weeks. This schedule was also adopted by the R.A.F.

The object of this paper is to describe in broad measure the overall toxic effects obtained with the penicillin and mapharside regime and, in greater particular, those of 405 of a greater number of cases treated at one of the four hospitals concerned. The therapeutic results will not be discussed at any length as these will be forthcoming in due course in the final analysis of the experiment as a whole. However, as a modified intensive treatment with mapharside may yet play some part in the rapid treatment of early lues, a detailed report of the toxic effects encountered may prove of interest.

Mapharside (oxyphenarson hydrochloride) is a drug which has been known for many years but only came into prominence immediately prior to the penicillin era when praiseworthy attempts were made in the U.S.A. to evolve a more rapid treatment for syphilis, attempts which, even with the enormous help derived from penicillin, have not yet achieved unqualified success. The main disadvantage of such intensive treatments with mapharside has been the increased incidence of what was formerly a rare event—the dangerous complication of arsenical encephalopathy. This complication is described severally as having, under prior long-term methods of treatment, an incidence of between 1:135,000 and 1:28,000 injections. When intensive methods came to be employed, it rose to 1.05 per cent of patients (as reported in the collected tables by Stokes [9], it being shown that the mortality was in inverse proportion to the period over which the drug was given. The incidence of encephalopathy though usually rare under the long term schedules, was found in World War II to have a high incidence in Indian troops, especially Tamils. Prebble [7] described 187 cases in India Command occurring between August, 1943, and March, 1945, all but two were Indian patients.

The dosages of mapharside employed in the intensive methods were, for example, 1,200 mg. by intravenous drip over five days; a similar dose over eight days and also 1.75 mg. per kilo in a single day. Multiple injection techniques were also employed giving 1,200 mg. of mapharside over longer periods of time. The United States Forces in Europe used a twenty-day scheme giving (combined with bismuth) 20 mg. per kilo body-weight in twenty equal daily doses and, on such a regime as this, the toxic effects of the drug were markedly less. Pillsbury *et al.* reported over 3,000 cases treated with no mortality [6].

Apart from the extensive American literature, there have been several recorded British experiences. Lydon [2] reported 5 cases of encephalopathy in 53 patients treated with 750 mg. of mapharside given in five two-hourly injections of 0.03 gm. daily for five days. Lloyd Jones and Maitland [1] reported

three instances of encephalopathy in 241 cases of early syphilis treated by daily injections of 0.04 to 0.06 gm. of mapharside given for ten, twenty or thirty days depending on the duration of the syphilis. On the other hand, Macfarlane [3] treated 73 cases with 0.06 gm. of mapharside daily for twenty days, 19 with the same dose daily for thirty days and 28 with the same dose three times weekly for seven weeks and there was no case of encephalitis and the mortality was nil.

THE SCHEDULE.

The course was intended only for cases of primary or secondary syphilis and consisted of 40,000 units of commercial penicillin given three-hourly to a total of 2.4 million units combined with ten daily injections of 0.06 gm. of mapharside commencing on the second day, though, in those cases where the primary fever had been severe and had not resolved by this time, the latter was postponed until the temperature was normal. The patients were kept in hospital but not always in bed and routine white cell counts were performed on the first or second day, the fourth to fifth and the eighth to ninth day. The urine was tested daily for urobilinogen and albumen, though jaundice and kidney complications were absent in this series. The patients themselves were examined daily for toxico-dermal reactions and a four-hourly temperature record was kept.

THE HOSPITALS.

This regime was employed at four hospitals. Three of these had facilities for good nursing while one had not. The writer was working at the last and, as a result of this, the more minor complications, which also arose at the other hospitals, received perhaps a little more respect than they deserved as far as modifying treatment was concerned. In all it was the practice, when any arsenical complication occurred, to discontinue the mapharside and extend the penicillin course to four million units.

The experience of serious reactions was, on the whole, small. There were three marked (one fatal), one mild and one doubtful case of encephalopathy in over 1,340 cases treated. This represents an incidence of 1:266 and a fatality rate of 1:1,340.

Hospital A.—Out of 219 cases treated only 10 showed secondary fever.

Hospital B.—Some 310 cases were treated and up to the last minute there were no untoward reactions apart from 2 cases of marked ninth-day erythema and one of urticaria. The former was treated with B.A.L.¹ though it was not certain that this drug accelerated recovery. The penultimate case showed secondary fever which was treated with B.A.L.; unfortunately followed by unexpected death in which the post-mortem findings were minimal but were attributed to arsenical encephalopathy.

Hospital C.—Of 243 cases treated, an interruption was made in respect of 22. 14 of these were for secondary fever, 6 for dermatological reasons (mainly urticaria and possibly due to penicillin), 1 for leucopenia and 1 for encephalopathy.

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The latter case was one of latent lues and the encephalopathy was heralded by an epileptiform convulsion, following quickly on the eighth injection; and coma soon ensued. During the next three days some 21 c.c. of B.A.L. were administered and the patient recovered.

Hospital D.—Some 570 patients were treated on this or similar schedules. There was one established, one mild and one doubtful case of encephalopathy. The severe case arose in a man with late secondary syphilis after only four arsenical injections had been given. He exhibited slight fever, headache, photophobia, extreme lethargy and inability to respond to the spoken voice or other external stimuli, associated with a markedly raised protein content of the cerebrospinal fluid. He was never unconscious and had no epileptiform seizures. He received B.A.L. and made a steady, if slow, recovery.

The mild case showed vomiting, a temperature of 99° F. and one epileptiform fit following immediately upon the tenth injection at the termination of treatment. He was given a short course of B.A.L. but was actually never really ill. The doubtful case had received seven injections when he complained of headache and had a temperature of 98·8° F. and also exhibited an epileptiform convulsion. Such fits, however, had occurred before the patient contracted syphilis. Apart from discontinuing the drug, no specific treatment was given.

There follows an analysis of 405 medically unselected patients treated on this regime. The remainder consists of some treated on similar but not identical schedules using neohalarsine, and others of the other Services treated concurrently on whom the data is not available in retrospect, though it is known that no serious complication occurred amongst them.

THE CASES.

The patients were as follows:—

Seronegative primary syphilis	..	166 cases	41·0 per cent.
Seropositive primary syphilis	..	164 cases	40·5 per cent.
Secondary syphilis	.. ..	75 cases	18·5 per cent.
Total		405 cases	100 per cent.

All were adult white males of an average age of 27·68 years. The average age of contraction was thus 1·6 years lower than that of 556 cases treated at the same hospital early in the war.

THE BLOOD-COUNTS.

The white cell counts of these patients, both before and during treatment, have been described in another place [11]. The initial counts showed no startling distinctions between seronegative primary, seropositive primary and secondary syphilis. There was only a very minimal increase in the numbers of lymphocytes and perhaps the large mononuclears as the disease progressed. Under treatment there was nothing distinctive in the reactions of the white cell count according to the duration of the disease though there was a general fall in the total count amounting to approximately 15 per cent. This decrease was most noticeable in respect of the neutrophil polymorphonuclears (19 per cent) though the large mononuclears and the lymphocytes both showed a

drop of 8.5 per cent. The eosinophils remained about stationary and the basophils showed a slight tendency to increase. Owing to the greater fall in the polymorphonuclear neutrophils, there was a small relative increase of all the other elements in the average percentage counts of the later examinations.

Cases showing a secondary pyrexia had a higher, those with severe Herxheimer reactions an average and those that later showed a leucopenia a lower than average initial white cell count. A more than average drop was noted in those showing dermatological complications and arsenical encephalopathy.

It was customary to modify treatment, suspending the arsenic and increasing the penicillin to four million units, if the total count fell below 4,000 or the neutrophil count below 40 per cent, though figures of below 5,000 and 50 per cent were very suspect and were frequently acted upon.

14 of the 166 seronegative primaries, 8 of the 164 seropositive primaries and 8 of the 73 secondary cases had their treatment altered on this account. No real instance of agranulocytosis or aplastic anæmia occurred and all the affected blood-counts made a spontaneous and complete recovery.

HERXHEIMER REACTIONS.

Pyrexias in the first twenty-four hours of treatment of between 99 and 104° F. were noted in 27 seronegative primaries, 30 seropositive primaries and 13 of the secondary cases. There was thus no significant difference in the incidence of this reaction according to the duration of the syphilis. There was nothing significant either in the behaviour of the white cell counts in the treatment of these cases and, apart from a short delay in commencing the administration of arsenic, no modification was made in the schedule.

UROBILINOGEN IN THE URINE.

There were no cases of toxic jaundice arising during, or shortly after, treatment though two cases were seen of the so-called syringe-transmitted variety with the usual hundred-day incubation period. However, 19 cases showed urobilinogen in the urine while actually receiving arsenic. Nine occurred on one of the first two days, being attributed to the pyrexial Herxheimer reaction. Two cases arose on each day of treatment from the fourth to the ninth day inclusive. Apart from an occasional temporary suspension of the mapharside for one day no other modifications were made and the condition did not recur.

SECONDARY PYREXIA.

This implies a rise of temperature after the primary fever had completely subsided or, if no such primary fever was observed, a rise of temperature forty-eight hours or later after the onset of treatment. Fourteen (8.4 per cent) of the seronegative primaries: 19 (11.6 per cent) of the seropositive primaries and 11 (14.6 per cent) of the secondary cases showed this complication. There was thus an increasing incidence according to the duration of the disease.

The white cell counts of these cases showed a slightly higher initial count though the proportionate drop was almost identical with the average for the whole. Of these 44 cases, in 20 the treatment with mapharside was resumed

after a stoppage of one or two days, while in the other 24 it was discontinued for good. Of this latter group, 7 had more or less severe reactions and included the 1 severe, 1 mild and 1 doubtful case of arsenical encephalopathy which have already been described. There was also 1 case with severe headache, 1 with tightness in the chest and 2 with ninth-day erythema.

DERMATOLOGICAL COMPLICATIONS.

In addition to the 2 cases of ninth-day erythema with pyrexia, there were 2 other instances of this disorder. Two others suffered from urticaria and possibly the penicillin was to blame, while 3 others showed seborrhœic types of reaction in which it was deemed wise to discontinue the mapharside. The majority of these cases occurred towards the end of the ten-day course and the white cell counts, while similar to the average for the whole in the initial count, fell to a much greater degree while under treatment, a finding which was also present in the 3 cases of actual or suspected encephalopathy.

HEADACHE AND OTHER SYMPTOMS.

Nine cases complained of headache without pyrexia, and treatment was stopped in 5. Treatment was also modified once for abdominal cramps, once for severe nausea, once for tinglings in the right forearm, once because of vomiting, once for a syncopal attack and in 1 patient who developed night sweats and was referred elsewhere for more detailed chest examinations.

Complications in which it was deemed necessary to modify treatment arose in 72. Thirty-two were in seronegative primaries (19·3 per cent), 21 were in seropositive primaries (12·8 per cent) and 19 in secondary cases, no less than 25·33 per cent. In the majority the modification consisted only of the omission of the last one, or possibly two, of the arsenical injections. If more than two were required to be withheld, extra penicillin was given raising the total to four million units.

CLINICAL RESULTS.

Little will be said at this stage as to the clinical results. Owing to demobilization and other factors, the individual hospitals suffered from a great run down in the follow-up, though it is hoped that information will be forthcoming concerning those cases transferred to other centres and from civilian clinics in response to the Ministry of Health letter and that finally some statistically satisfactory figures will be available. Only approximately 20 per cent of this series were seen during the one hundred and twenty to one hundred and eighty day period after treatment, and the month by month percentages of the seropositive cases reaching seronegativity were:—

PERCENTAGE BECOMING SERONEGATIVE MONTH BY MONTH.

0	1	2	3	4	5	6
nil	33·3	65	75	76·6	86·2	83·3

THE FAILURES.

Eighteen cases of relapse-reinfection were personally observed, 4 of which were seen at civilian hospitals and not as part of the reduced follow-up that

has been described. Of these cases, 4 arose from seronegative primaries, 11 from seropositive primaries and 3 from the smaller number of secondary cases. Of the 14 who were originally seropositive, 10 had become completely seronegative in the interval before the relapse-reinfection while 4 had not.

Dark-field positive lesions were found in 13 of the failures, in 6 of which the lesions were multiple though not always of an obvious nature. One of these cases was associated with a syphilitic hepatitis, showing jaundice with an enlarged liver in addition to dark-field positive lesions on the scrotum. Dark-field positive lesions with a negative blood were noticed in 2. Serological relapses, in cases which previously had been completely seronegative, occurred in 4 and 1 case had seroresistance associated with a non-healed sore in which treponemata could not be recovered at six weeks.

Some of these cases were undoubtedly reinfections and the wives were known to have contracted the disease in the interval between the attacks in 3. The time between the original infection and the relapse-reinfection varied between two and eleven months, average 4.4 months.

TIME INTERVAL BETWEEN ORIGINAL INFECTION AND RECURRENCE.

Months	..	1	2	3	4	5	6	7	8	9	10	11
Number of cases		1	2	4	3	5	0	1	1	0	0	1

SUMMARY.

The toxic effects of a schedule consisting of 600 mgm. of mapharside given in ten daily injections combined with 2.4 million units of commercial penicillin have been described.

In all nearly 1,350 cases were treated and there was 1 fatality. In addition there were 2 severe, 1 mild and 1 doubtful case of arsenical encephalopathy. No immediate case of jaundice occurred in the entire series.

Four hundred and five of the cases treated at one hospital have been studied in greater detail.

Treatment was modified in 72 of which 30 were due to an excessive fall in the white cell count; 24 to a secondary pyrexia associated in 3 with 1 severe, 1 mild and 1 doubtful case of encephalopathy, in 2 with nine-day erythema, and 2 with other symptoms. Treatment was adjusted in 7 others for skin complications, 5 on account of headaches and in 6 others for a variety of symptoms.

There was no case of jaundice though 19 had transient urobilinogen in the urine and treatment was not modified. The incidence of Herxheimer reactions was not affected according to the duration of the disease though secondary cases generally required the treatment to be modified more frequently than those of primary syphilis.

Of the very low proportion that were followed, one-third of those originally seropositive were negative at one month, two-thirds at two months, three-quarters at three and 83.6 per cent at six months.

Eighteen cases of relapse-reinfection were observed and have been described.

Due acknowledgments are expressed to the whole of my Staff during the period of these trials and especially to Serjeant F. Stevens, R.A.M.C., and

Serjeant J. Badger, R.A.M.C., and also to Lieut.-Colonel R. H. Simon, Lieut.-Colonel B. Levy, Major R. H. Wordingham and Major W. H. Webster for their personal communications and data supplied.

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AN INVESTIGATION INTO THE POSSIBLE EFFECTS OF INTRAMUSCULAR INJECTIONS OF BISMUTH ON THE PENICILLIN CONTENT OF THE BLOOD SERUM WHEN GIVEN CONCURRENTLY WITH PENICILLIN IN THE TREATMENT OF EARLY SYPHILIS.¹

BY

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IN view of the fact that the heavy metals are well known to have the effect of inactivating penicillin *in vitro* (Bacharach and Hems, 1946), it was decided to carry out an investigation in a small series of cases to determine the possible adverse effects of the intramuscular injection of bismuth on the blood levels of penicillin, when the two are given concurrently in the treatment of syphilis, as is the case in the routine scheme of treatment for early syphilis at present under trial in the Army (Scheme "D").

Patients under treatment by Scheme "D" receive, while in hospital, a total of 4 mega units of penicillin given in three-hourly intramuscular injections of 50,000 units dissolved in sterile distilled water over a period of ten days. In addition, on the second, fifth and ninth days, while still in hospital, the patient is given 0.3 gm. N.A.B. plus 0.2 gm. bismuth; 0.45 gm. N.A.B. plus 0.2 gm. bismuth and 0.6 gm. N.A.B. plus 0.2 gm. bismuth respectively. Thereafter, the patient is given 0.6 gm. N.A.B. plus 0.2 gm. bismuth at weekly intervals for eight weeks as an out-patient. The total is 4 mega units of penicillin, 6 gm. of neoarsphenamine and 2.2 gm. of bismuth. The penicillin preparation used in all cases in this investigation was partially purified commercial sodium penicillin, manufactured by Glaxo Laboratories, Ltd. The bismuth preparation used was a commercial form of *Injectio Bismuthi B.P.* (20 per cent suspension of bismuth metal in isotonic glucose solution).

METHOD OF INVESTIGATION.

For the purpose of this investigation serum was obtained from a series of 50 patients under treatment for syphilis in the V.D. wards of the Royal Herbert Hospital, Woolwich. Alternate patients received the normal Scheme "D" treatment. In the case of the intervening patients (the controls) the bismuth and arsenical injections were omitted while in hospital, being given afterwards as an out-patient for the ten weeks following completion of penicillin treatment. It should be stated here that, as it is generally conceded that arsenic is at least not antagonistic to penicillin, and may have a synergistic effect

¹This paper describes the results of an investigation carried out at the instigation of the Sub-Committee on Venereology of the Army Medical and Personnel Research Panel.

TABLE I.—COMPARATIVE TABLE TO SHOW THE HIGHEST TITRE AT WHICH PENICILLIN IN SERUM OF PATIENTS TREATED WITH PENICILLIN ONLY AND PENICILLIN WITH ARSENIC AND BISMUTH CAUSED INHIBITION OF THE GROWTH OF STAPHYLOCOCCI.

Patient's number	Day of treatment	Maximum titre of serum causing inhibition of staphylococci		Patient's number	Day of treatment	Maximum titre of serum causing inhibition of staphylococci	
		Penicillin c As. & Bi	Penicillin only			Penicillin c As. & Bi	Penicillin only
1 & 2	1st	1/8	Nil	21 & 22	1st	Nil	1/8
	3rd	Partial 1/4	Nil		3rd	Partial 1/8	1/8
	7th	Nil	Nil		7th	Nil	Nil
	10th	1/8	Nil		10th	1/2	Partial 1/4
5 & 6	1st	1/8	Nil	23 & 24	1st	1/4	Partial pure
	3rd	1/8	1/4		3rd	1/8	1/8
	7th	Nil	Nil		7th	1/8	1/8
	10th	Nil	Nil		10th	1/8	1/2
7 & 8	1st	Pure	Partial 1/2	25 & 26	1st	Pure	1/4
	3rd	Nil	Nil		3rd	Nil	Nil
	7th	Partial pure	1/4		7th	Partial pure	Partial pure
	10th	1/8	Nil		10th	Nil	1/2
9 & 10	1st	Nil	Nil	27 & 28	1st	Nil	Partial pure
	3rd	Pure	Nil		3rd	1/8	1/2
	7th	1/4	1/8		7th	Nil	1/8
	10th	1/8	1/8		10th	Partial 1/8	1/8
11 & 12	1st	Partial pure	Partial 1/4	33 & 34	1st	Nil	1/8
	3rd	Nil	Nil		3rd	1/2	1/8
	7th	1/8	1/8		7th	1/8	1/8
	10th	1/8	Partial pure		10th	Nil	1/8
13 & 14	1st	Nil	Nil	37 & 38	1st	Nil	Partial 1/2
	3rd	Nil	Partial pure		3rd	Partial 1/8	1/8
	7th	1/8	1/4		7th	1/8	Pure
	10th	1/4	Nil		10th	1/8	Nil
15 & 16	1st	1/8	1/8	43 & 44	1st	1/2	Pure
	3rd	1/2	Nil		3rd	Pure	Partial 1/2
	7th	1/8	1/2		7th	Pure	1/8
	10th	1/8	Nil		10th	Nil	1/8
17 & 18	1st	1/8	Nil	49 & 50	1st	1/8	1/2
	3rd	Nil	1/8		3rd	1/8	Nil
	7th	Partial 1/4	1/4		7th	1/8	Pure
	10th	1/2	Nil		10th	Partial 1/8	1/8
19 & 20	1st	Nil	Nil				
	3rd	1/8	Nil				
	7th	Nil	Nil				
	10th	Partial 1/2	Nil				

(Selbie and Herbert, 1946, and Eagle *et al.*, 1946), the arsenical injections were not omitted in the case of those patients treated by Scheme "D," it not being considered that the effect of neoarsphenamine was likely to materially offset any possible ill-effects of the bismuth.

Samples of blood were taken from each patient in both groups on the first day of treatment three hours after the first injection of penicillin, and thereafter on the third, seventh and tenth days at the time the 9 a.m. penicillin injection was due—i.e. three hours after the 6 a.m. injection of penicillin. For various reasons it was only possible to carry out estimations on the complete series of four samples (*viz.* first, third, seventh and tenth days of treatment) on 17 of the patients receiving bismuth and 17 of the controls. In the remaining 8 patients and their controls estimations were carried out on the first, third and seventh days of treatment only.

Blood samples were sent by hand to the Royal Army Medical College Pathological Laboratory where one of us (G. T. L. A.) carried out estimations of penicillin on each sample, using staphylococcus as the test organism. The estimations were made using pure serum and dilutions of serum in saline of 1:2, 1:4, 1:8. In a certain number of cases the same procedure was carried out using streptococci as the test organism. The methods of testing employed were as follows:—

(1) Serial doubling dilutions of the serum to be tested were made in 1:10 serum. Each dilution was inoculated with a loopful of a young culture of the

TABLE II.—COMPARATIVE TABLE TO SHOW THE HIGHEST TITRE AT WHICH PENICILLIN IN SERUM OF PATIENTS TREATED WITH PENICILLIN ONLY AND PENICILLIN WITH ARSENIC AND BISMUTH CAUSED INHIBITION OF THE GROWTH OF STAPHYLOCOCCI.

Patient's number	Day of treatment	Maximum titre of serum causing inhibition of staphylococci		Patient's number	Day of treatment	Maximum titre of serum causing inhibition of staphylococci	
		Penicillin c As. & Bi	Penicillin only			Penicillin c As. & Bi	Penicillin only
3 & 4	1st	Nil	Nil	39 & 40	1st	Nil	Nil
	3rd	Nil	1/8		3rd	Nil	Partial 1/2
	7th	Nil	Partial pure		7th	1/8	Nil
	10th	Nil			10th		
29 & 30	1st	Pure	1/2	41 & 42	1st	1/8	Pure
	3rd	Pure	Nil		3rd	Pure	Pure
	7th	Partial 1/8	1/8		7th	1/8	1/8
	10th		Nil		10th		Pure
31 & 32	1st	1/4	1/8	45 & 46	1st	Partial 1/4	Nil
	3rd	1/8	Nil		3rd	Partial 1/8	1/8
	7th	1/8	Nil		7th	1/8	Nil
	10th		Nil		10th		
35 & 36	1st	Nil	1/2	47 & 48	1st	1/8	Nil
	3rd	Partial 1/4	Partial 1/2		3rd	1/8	1/8
	7th	Partial pure	1/8		7th	Nil	Nil
	10th		Pure		10th		

Oxford strain of *Staph. pyogenes* and introduced into the modified slide cell of Bigger *et al.*, 1944. The highest dilution tested was 1:8.

(2) For a number of samples parallel tests were performed on serial dilutions of the serum in saline by the addition of 1/5 volume of blood (diluted 1:2, heated to destroy leucocytes, and of type "O," or a type compatible with the serum under test) which had been inoculated with *Strep. pyogenes* Milne, and the incubation of the mixtures in capillary tubes (Fleming, 1944).

In general, the results of the two methods showed relative agreement, the bactericidal titre being usually slightly higher as estimated by method 2.

In addition, the following procedure was carried out for purposes of control:

(a) To confirm the visual reading by these two methods, subcultures from the slide cell chambers and from the capillary tubes respectively were taken from a proportion of samples.

(b) To demonstrate that the bacteriostatic (or bactericidal) effects observed were due to penicillin and not to antibacterial powers of the serum or to the presence of other drugs in the circulation, parallel tests were made on a number of samples in which penicillinase was added to each dilution of the serum examined. The diminished or negative titre in such controls indicated that penicillin was the effective agent in producing the bactericidal effects observed.

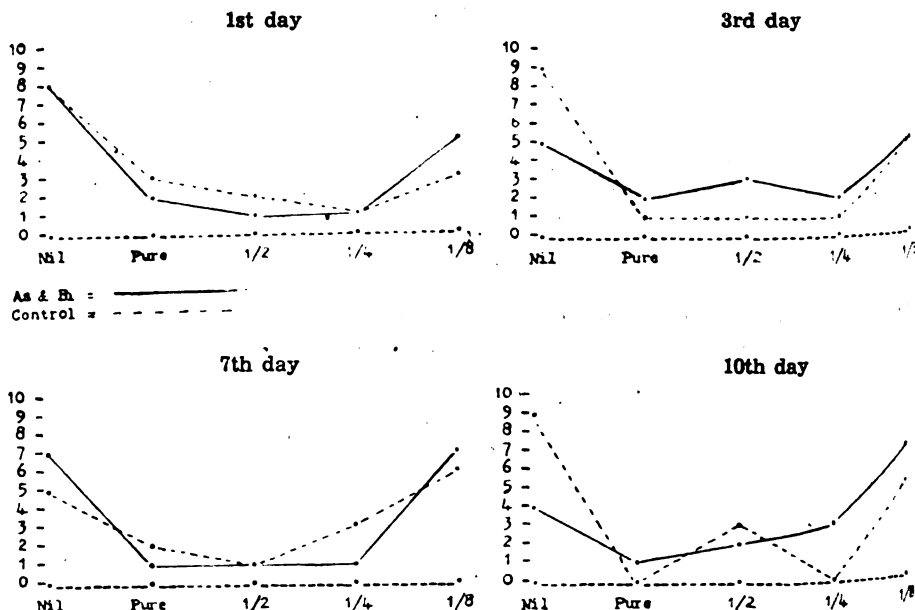


FIG. 1.—Daily frequency distribution of maximum titres of serum causing complete inhibition of staphylococci by totals of all sera (both experiment and control) 34 cases—four tests.

RESULTS OF THE INVESTIGATION.

Clinically the effect of treatment on the lesions of patients was materially the same in the series treated with penicillin alone as in the series treated with penicillin, arsphenamine and bismuth.

Table I shows the highest titre at which penicillin in the serum of each of 17 patients and their controls inhibited the growth of staphylococci. In this series estimations were carried out on the first, third, seventh and tenth days of treatment. Table II shows the results obtained in the 8 patients and their controls in the case of whom estimations were carried out on the first, third and seventh days of treatment only. The results of these estimations in which sera was tested using streptococci as the test organism did not appear to differ from those in which the staphylococcus was used.

Fig. 1 shows graphically the daily frequency distributions of the maximum

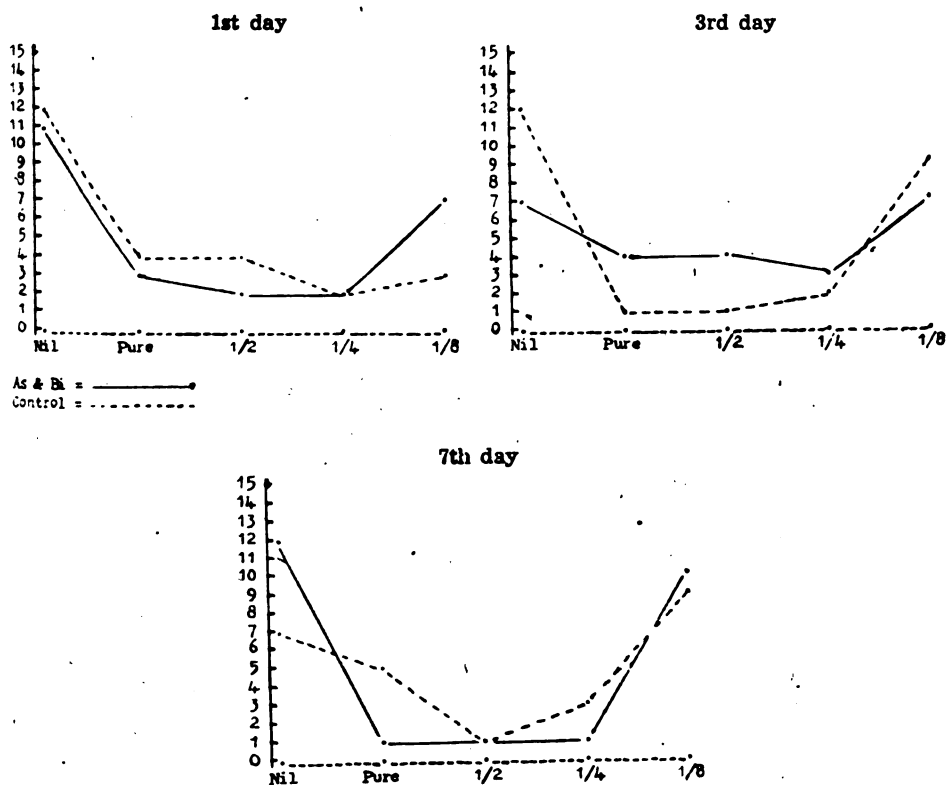


FIG. 2.—Daily frequency distribution of maximum titres of serum causing complete inhibition of staphylococci by totals of all sera (both experiment and control) 50 cases—three tests.

titres causing complete inhibition obtained in all sera in the case of each group of the 34 patients shown in Table I on days of treatment at which serum was examined. These results were obtained by adding together the number of patients showing the same level at which complete inhibition of growth of staphylococcus occurred on each day of treatment on which examinations were made, and plotting a curve for each series (first day, third day, seventh day, tenth day).

Fig. 2 gives a similar representation for the total of all 50 patients (34 in

Table I and 16 in Table II) for the three series of specimens of serum (first day, third day, and seventh day of treatment).

Fig. 3 shows the curve of the maximum titres of inhibition of staphylococcus of the 17 cases and controls shown in Table I, irrespective of the day of examination. In this figure the number of sera showing the same titre causing complete inhibition in each group (test and control) on any day were added together, and the curve plotted.

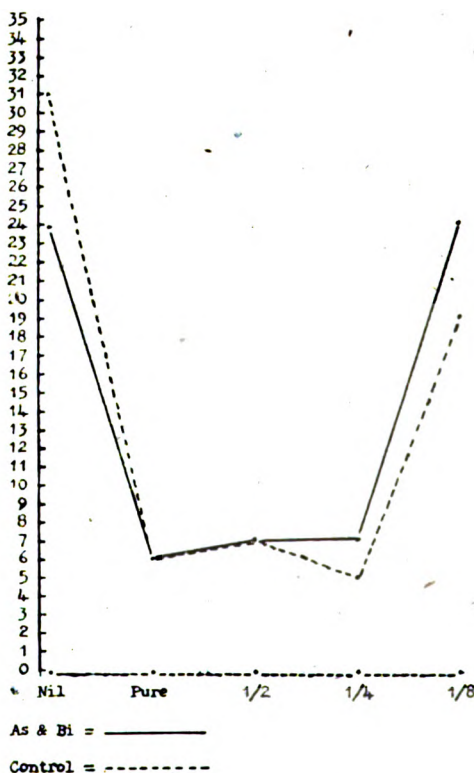


FIG. 3.—Frequency distribution of maximum titres of serum causing complete inhibition of staphylococci shown by all sera (both experiment and control) irrespective of day of treatment. 34 cases—four tests.

Fig. 4 shows a comparison of the highest titres of serum causing complete inhibition shown by all sera for each day of treatment on which an examination was made between the 17 bismuth-treated cases and control group (Table I). To obtain this, the serum dilution in each case was given an arbitrary comparative numerical value, viz.: no inhibition=0, pure serum=3, a dilution of 1:2=6, a dilution of 1:4=9, a dilution of 1:8=12. The values of each specimen in both groups (test and control) for each day were added together and a mean taken.

For all of the above representations partial inhibition of growth of staphylococci has been disregarded, the highest titre at which complete inhibition occurred only being used.

It should be remembered that no bismuth preparation had been given in the case of both test and control groups in the sera examined on the first day of treatment.

DISCUSSION OF THE RESULTS.

If one compares the highest dilutions of sera in which inhibition of staphylococci occurs in the case of those patients treated with penicillin plus bismuth and arsenic with those of patients treated with penicillin alone (as shown in Tables I and II), it will be seen that there appears to be considerable divergence in the levels of inhibition shown by individual samples, which varied from no effective bactericidal effect to a bactericidal effect by serum

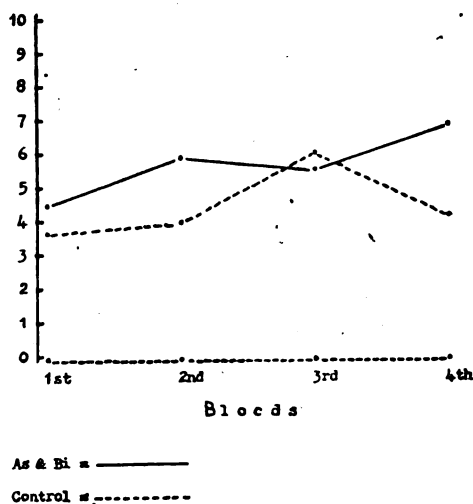


FIG. 4.—Comparison of maximum titres of 34 cases (both experiment and control) for each day of test. (For basis of compilation see text.)

diluted to the highest titre tested, viz. 1:8. But such divergence is relatively evenly distributed between the test and control groups, and in both groups a bactericidal effect occurred in a proportion of individual sera at some of each of the intervals at which serum was tested. This even distribution of divergence is well demonstrated in figs. 1, 2, 3 and 4, in which the results obtained for both test and control groups show the same general tendency.

The marked and irregular variation in bactericidal effect of different samples of serum from the same individuals, and of serum from different individuals at the same stage of treatment throughout this investigation may have been due to:—

(1) Dose and Interval: The level of penicillin in the blood produced by the injection of 50,000 units intramuscularly may be expected to have fallen considerably after three hours, and to continue to fall rapidly during the next hour

(e.g. the inhibiting dilution in the serum may fall from $1/32$ to $1/4$ in three hours and to $1/1$ one hour later—Fleming *et al.*, 1944). Hence with this dose and interval, small variations in excretory powers, and slight prolongations of the interval, may be reflected in considerable variations of the bacteriostatic serum dilutions observed. The interval of three hours was used as being of practical importance as regards therapy, since it is the interval between doses. However, from the point of view of uniformity of results, it is less satisfactory, as being an interval at which major fluctuations of the serum penicillin content may be found with small time deviations.

(2) Inactivation of Penicillin by Serum (Bigger, 1944): Owing to circumstances beyond our control it was impossible to observe any regular interval between the taking and testing of blood samples. One specimen from an individual might be put up after an interval of a few hours while other specimens arriving late in the day, or at the weekend, might not be tested for one or two days. Maintenance in the interval was, when possible, in the refrigerator, but owing to current conditions this was not invariably possible.

(3) Other Possible Causes, e.g. Contamination: There would, however, appear to have been an equal liability to the effect of the above factors in serums from both the test and control groups, and the marked variation in bactericidal powers of serum withdrawn at each interval from different individuals, and at different intervals from the same individual which has been noted, has in fact been found in both the test and control groups.

The number of cases in which the investigation was carried out was necessarily small, and larger numbers than facilities allowed would be required to obtain a conclusive answer. However, while the small number of cases does not permit of a statistically clear-cut result, the figures suggest that the concurrent exhibition of bismuth (and neoarsphenamine) and penicillin does not result in inactivation of the penicillin in the blood serum. In this connexion, the possible effect of bismuth on the renal excretion of penicillin may well merit further consideration and investigation.

SUMMARY AND CONCLUSIONS.

(1) The effect of the exhibition of bismuth (and neoarsphenamine) concurrently with penicillin on the penicillin content of the blood serum is compared with controls in which penicillin without bismuth or arsenic is used in a small series of cases of early syphilis, and the results are discussed. Whilst the number of cases used for the purpose of this investigation is small, allowing for individual variations, the results of the estimations of penicillin in the serum of those patients receiving bismuth do not materially differ from those receiving penicillin alone.

(2) The immediate clinical response of treatment in cases treated by means of penicillin alone and penicillin combined with bismuth and arsenic was found to be the same.

(3) The results of the investigation suggest that intramuscular injections of bismuth do not inactivate the penicillin in the blood serum, and it is there-

fore reasonable to conclude that the two can be given concurrently in the treatment of syphilis.

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SALINE TEST FOR STREPTOCOCCAL HÆMOLYSIN

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IN medical bacteriology, streptococci were classified primarily into α , α prime, β and non-hæmolytic types according to the changes produced by their growth on solid blood-agar (Schothmuller, 1903; Smith and Brown, 1915, etc.). Marmorek (1895) showed that fluid cultures of certain streptococci lysed added red cells, and Braun (1912) correlated the hæmolysis on blood-agar medium with the production of a filtrable hæmolysin in serum broth. The studies of streptococcal hæmolysin by McLeod (1912) and others, the observations of de Kruif and Ireland (1920) that the hæmolytic activity of a serum broth culture reached a maximum in eight hours and then diminished, and the discovery of the oxygen and heat-labile hæmolysins by Todd (1934) led to a test for the detection of soluble streptolysin.

In this method 0.5 to 1.0 c.c. of an eight to fourteen-hour whole culture of the streptococcus in 20 per cent serum broth, or of the supernatant after centrifuging, is added to an equal volume of 5 to 10 per cent washed horse blood cells, the mixture incubated for one to two hours and the presence or absence of hæmolysis noted. This method has the disadvantage that owing to the variability of streptolysin production in the early period of growth and its lability later on, false negative results might be obtained if the culture is less than eight, or more than fourteen hours old. Moreover, the interval between commencing and reading the test varies from ten to sixteen hours and this usually entails the inoculation of the serum broth or the addition of the washed cells after normal laboratory hours.

In the new method, henceforth called the saline hæmolysin test, streptococcal colonies are picked off from the overnight primary blood-agar plate and emulsified in about 1 c.c. of sterile saline in a small test tube. Within limits the heavier the suspension, the quicker hæmolysis occurs; if too few cocci are added, false negatives occur. As will be shown later at least ten colonies of the streptococcus should be emulsified. One drop of defibrinated or oxalated horse blood is added to the suspension, the tubes shaken and incubated at 37° C. A control tube of saline plus blood is desirable but not essential. The tube should be examined and shaken every half to one hour for at least four or five hours. Most positive results will be obtained well within this period but negative results should not be recorded for seven or eight hours or preferably overnight.

This test was discovered through an accidental experiment set up by a serjeant-technician, in which hæmolysis, within two hours of incubation, was observed in a saline suspension of a hæmolytic streptococcus, to which had been

added a drop or two of defibrinated horse blood. As this observation promised a simple and more rapid method of detecting streptolysin, thirty strains of streptococci producing β zones of hæmolysis on horse blood-agar were tested over a period. The technique was as follows:—

After isolation in subculture, the organism was grown on a horse blood-agar plate to verify its purity and β hæmolysis: to a moderately heavy suspension of this growth in 1 to 2 c.c. of sterile isotonic saline was added one drop of sterile, defibrinated horse blood. After shaking to mix the contents, the tube was incubated at 37° C. and examined every half to one hour for eight hours, and if necessary the following morning too. A control tube containing only saline and blood was also set up.

In these and all subsequent experiments results were recorded as follows: viz. +++ complete hæmolysis, ++ strong but incomplete lysis, + definite lysis, tr. trace of lysis, and O no lysis.

Of the thirty strains, only four gave negative results, three on one occasion only, giving complete or incomplete lysis in one or more repeat experiments. The fourth strain failed to produce lysis in three experiments. This was the Group D strain referred to below; two of the others were Group A, one Group C. All four strains produced soluble hæmolysin against horse cells when grown in 20 per cent serum broth. Forty-two tests were performed on the remaining twenty-six strains: thirty-two showed complete lysis, eight strong but incomplete lysis, and only two the lesser lysis recorded as +. In Table I the number of experiments in which at least ++ hæmolysis occurred, and the minimal periods required for this degree of lysis to develop, are recorded. Of the forty tests, thirty reached this stage in less than three hours, and in only five was it delayed longer than seven hours.

TABLE I.—TO SHOW THE NUMBER OF TESTS DEVELOPING AT LEAST ++ DEGREE OF HÆMOLYSIS IN VARIOUS PERIODS.

		<i>Appearance of ++ lysis in hours</i>							
		$\frac{1}{2}$	1	1½	2	3	4	5	6
No. of tests..		11	5	4	4	6	2	1	2
									>7
									5

Eighteen of the thirty strains were grouped by Lancefield's (1933) method: thirteen were Group A, one Group D, and two Group G. The C and G strains and five of the Group A strains were obtained from the Lister Institute, twelve of the others were isolated from human throat infections, the Group D strain which was a typical enterococcus, from a case of pyelocystitis, and the remainder from various purulent infections.

Twenty-one tests for production of soluble hæmolysin were carried out. The organism was grown in 20 per cent horse serum broth for ten to twelve hours, the culture centrifuged and washed horse cells added to the supernatant fluid. Results were read after two hours incubation at 37° C. Three tests were negative, but when repeated were strongly positive: all others were positive.

The results of such small numbers cannot be too widely interpreted, but it seems that the saline hæmolysis test which gave 87 per cent of positives if ++ hæmolysis is taken as the minimal end-point, or 91 per cent if + degree of

hæmolysis is accepted, is at least as efficient as the longer method which gave 85 per cent of positive results.

CONTROL EXPERIMENTS.

A series of experiments were performed on organisms other than β hæmolytic streptococci to discover the specificity and accuracy of the new test. First, fourteen strains of viridans¹ and two of non-hæmolytic streptococci were tested for hæmolysin by the saline test. Fifteen of these gave completely negative results even when left overnight and read the following day: but in one test, hæmolysis commenced in one and a half hours and was ++ in four hours. This was the strain which showed a zone of β hæmolysin in addition to the green discoloration around the colonies, and it was considered possible that, if cultured anaerobically, this may be classified as a true β hæmolytic streptococcus (see Fry, 1933). Unfortunately the organism died out in subculture and this theory could not be tested.

Eighteen organisms, other than streptococci, were also tested. These were eight strains of coagulase-positive staphylococci, five of which showed zones of β hæmolysis around their colonies on horse blood-agar, two hæmolytic coliform strains, three diphtheroids (one β hæmolytic) and one strain each of *C. diphtheria gravis*, *B. dysenterix*, Sonne and Flexner, *Ps. fluorescens* and *B. paratyphosum* A. All tests gave uniformly negative results in eighteen to twenty-four hours, although certain organisms, particularly the staphylococci, produced a dirty purplish discoloration of the non-hæmolysed blood.

OPTIMUM BLOOD-SALINE PROPORTIONS.

The success of the saline hæmolysin test is probably due to one of two mechanisms. Preformed lysin may be extracted from the saline suspension of intact cocci into the serum or plasma of the added blood: alternatively formation of new hæmolysin may occur by growth of the streptococcal suspension in the blood-saline medium. Whichever is true there may be an optimal serum concentration for the test.

To examine this possibility, tubes containing descending dilutions of horse serum in saline were set up in final volumes of 1 c.c. Experiments on four strains known to produce hæmolysin were performed. A heavy suspension from an overnight culture on blood-agar was made in each tube and washed horse cells added. In some experiments, one "standard" drop of packed cells was added to each tube, in others 0.5 c.c. of a 10 per cent suspension of cells in saline was used. A typical result is shown in Table II.

TABLE II.—TO SHOW THE RELATIONSHIP BETWEEN CONCENTRATION OF HORSE-SERUM AND THE RATE AND EXTENT OF HÆMOLYSIS.

Time in hours	Final concentrations of horse-serum in normal saline						Uninoculated saline control
	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	0	
$\frac{1}{2}$..	0	0	0	0	TR.	0	0
1 ..	0	0	0	+	++	0	0
2 ..	0	0	+	++	+++	TR.	0
3 ..	TR.	+	+++	+++	+++	+	0
6 ..	+	++	+++	+++	+++	+	0

¹ One of these produced a zone of β hæmolysin in addition to green discoloration.

In general the results showed that neither normal saline alone, nor concentrations of serum greater than 25 per cent, favoured rapid or extensive hæmolysis, and that under the conditions of the experiments, the optimum serum concentration was in the region of 2 to 10 per cent. Happily the addition of one or two drops of blood to 1 or 2 c.c. of saline gives a serum concentration of this order, so that the ratio of blood to saline originally and subsequently used in the tests, is the optimum one for the experiment.

SENSITIVITY OF THE TEST.

The real value of the new method, besides its theoretical interest, is the rapidity and ease with which it tests for hæmolysin. In addition it is unnecessary to subculture the streptococcus from the primary blood-agar plate. In practice it would not be always of value if a heavy suspension of the test streptococcus was essential, since the colonies are small, and if only a few were available, a false negative result may be obtained. Experiments were set up to discover the minimal suspensions of streptococci in saline necessary to ensure rapid hæmolysis.

Owing to the granularity of streptococcal suspensions and the related difficulty of calculating density of cocci per c.c., the strength of the suspensions were recorded in colonies per c.c. This of course is not very accurate, but has a practical advantage. The sensitivity of the test was investigated by removing colonies of average size from an eighteen to twenty-four hour blood-agar plate culture and suspending increasing numbers of them in saline volumes of 1 c.c. Numbers of colonies varying from one to sixty-four were used, and as usual one drop of defibrinated horse blood was added to each tube. These were shaken, incubated at 37° C. and read every half to one hour, when they were again shaken. Ten strains known to produce hæmolysin were selected for these experiments. Typical results are recorded in Table III.

TABLE III.—TO SHOW THE RELATIONSHIP BETWEEN THE STRENGTH OF THE SUSPENSION AND THE RATE AND EXTENT OF HÆMOLYSIS.

Strain	Time in hours	No. of colonies in 1 c.c. of saline					
		0	1	3 to 4	6 to 8	12 to 16	24 to 32
Strep. Poole	$\frac{1}{2}$	0	0	0	0	++	+++
	1	0	0	0	+	+++	+++
	2	0	0	TR.	++	+++	+++
	4	0	0	+++	+++	+++	+++
	6	0	TR.	+++	+++	+++	+++
Strep. Farley	$\frac{1}{2}$	0	0	0	0	0	0
	1	0	0	0	0	0	0
	2	0	0	0	0	TR.	++
	4	0	0	TR.	+	++	+++
	6	0	0	+++	+++	+++	+++
Strep. Spires	$\frac{1}{2}$	0	0	0	0	0	0
	1	0	0	0	0	0	0
	2	0	0	0	0	0	+
	4	0	0	0	TR.	+	++
	6	0	0	TR.	+	++	++

It was found that the greater the number of colonies used, the more rapid the hæmolysis. In some cases as few as three or four colonies produced strong or complete lysis in three or four hours, but more often six to twelve colonies were necessary to produce a similar change in the same period. In general it may be said that at least ten colonies should be emulsified in the 1 c.c. of saline, and, if possible, heavy emulsions should be made to ensure a quicker and more accurate result.

DISCUSSION.

Compared with testing for soluble hæmolysin production in serum broth culture, the advantages of the saline hæmolysin test are first, its simplicity and relative rapidity, and secondly that it is unnecessary to subculture the streptococcus, as the test can be performed from colonies on the overnight primary blood-agar plate. Moreover, as it seems that other organisms, even those producing β hæmolysis on solid blood agar, give a negative test, the accidental picking off of colonies other than streptococci has no influence on the final result. However this admixture should be avoided as far as possible. If possible a heavy saline suspension of streptococci should be made to avoid false negatives.

The origin of the hæmolysin involved in the test, and its relationship to the O and S lysins described by Todd (1934) are under investigation.

SUMMARY.

A new method for the detection of streptococcal hæmolysin is described in which an emulsion of streptococci from the primary blood-agar plate is made in about 1 c.c. of normal saline and one drop of defibrinated or oxalated horse blood is added.

The test is as reliable as McLeod's method but is simpler and more rapidly carried out.

ACKNOWLEDGMENT.

I wish to thank Colonel J. D. Gripper, and Lieut.-Colonel E. H. Hall. R.A.M.C., A.D.P. Southern Command, for permission to forward this article for publication.

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TRAUMATIC DIAPHRAGMATIC HERNIA.

BY

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[Received June 1, 1947.]

THIS is not a rare condition. Chest units see it frequently; it is also a trauma that traumatic surgeons are likely to see. Traumatic surgery is one field of surgery in which surgeons in the Corps have considerable experience. During my service I have had something to do with three patients suffering from this condition.

American literature frequently describes traumatic diaphragmatic hernia but there are fewer references in British journals and one of the infrequent references is found in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS (Swinney). More recently in this Journal Vere Nichol briefly describes a case. And it is worth while mentioning that this lesion was first described by an Army Surgeon, Ambroise Paré (Morrison).

The purpose of this Paper is to remind surgeons in the Corps of this trauma to recall the thoracic approach (which gives excellent access for the reduction of the hernia and the repair of the defect) and to emphasize that a skilled anaesthetist is necessary.

In the three cases I have seen there were three common factors:—

- (1) Desperately ill men on admission.
- (2) History of crush accident.
- (3) Diagnosis of traumatic diaphragmatic hernia suggested during the recovery from initial shock by hearing abdominal sounds in the pleural cavity on auscultation of the chest and confirmed by means of a barium follow through.

This is well shown in the case-history of the third patient which is as follows:

One hour before admission to a hospital in B.A.O.R., Pte. R., aged 21, was run over by a wheel of a 3-ton lorry which partially compressed his left leg and abdomen.

When admitted almost moribund, he was sweating profusely, colour ashen, pulse just palpable and very thready. He was immediately given 2 pints of plasma in thirty minutes and morphia intravenously followed by 1 pint of blood more slowly. One hour later his colour and pulse had improved considerably but he was then cyanosed. His B.P. was 134/70.

At this stage examination showed: Dyspnoea with a respiratory rate of 36/min. He complained of severe pain in left upper abdomen. The apex beat was 1 in. inside nipple line, and the right border of the heart 2 in. to right of sternum, while the trachea was to right of the mid-line. Air entry was diminished over the whole of the left side of the chest and absent in lower axilla up to the level of second space. The chest was dull

to percussion in this area. Compensatory emphysema was present in upper portion of left and whole of right lungs. The coin sounds in left side were suggestive of presence of air in the thorax. The abdomen was completely rigid all over, and hyper-peristalsis was audible. The liver dullness was present.

Three hours later : very much more dyspnoea with considerable bubbling in chest and cyanosis marked. Chest signs were more marked over the same area as noted before. The respiratory rate was now 48 but the pulse was improved. The head of the bed was raised, continuous oxygen through BLB mask started and atrophine 1/100 gr. given.

Eight hours later: much improved. The colour and general condition were better. He complained of less pain. Respiratory rate was 36 and bubbling had decreased. Fourteen hours later improvement was maintained but he had twice vomited 2 oz. of stomach contents containing blood. I.V. plasma was discontinued.

One day after injury the respiration was 36 but he was less distressed. Chest signs were unchanged. Traumatic asphyxia of face and neck was now present. Abdomen: he complained of spasmodic pains in epigastrium radiating to the left shoulder. The abdomen was soft though still rigid in epigastrium. He vomited small quantities several times during the night, and blood was still present in the vomitus. He passed urine.

Further examination showed a hæmatoma in left sacro-iliac region. The right ankle was very swollen and painful. X-ray of chest, lumbar spine, pelvis and right ankle showed no bony injury. I.V. glucose saline was commenced and discontinued after 3 pints. He did not vomit for twenty-four hours in spite of being given fluids by mouth (sips). That evening the chest was aspirated but nothing was withdrawn.

Two days after the injury the respiratory rate was raised. Chest aspiration again attempted but nothing found.

Four days after injury he was much improved but he still had occasional epigastric pain but no vomiting. Respiratory rate was 28 to 30 constantly.

Seven days after injury the chest was aspirated and 2 oz. of blood withdrawn from left pleura.

Nine days after injury auscultations in the left axilla revealed added sounds which were believed to be either bowel sounds or due to pleural friction. A barium meal was therefore given and revealed the stomach and transverse colon lying above the left diaphragm.

On the sixteenth day after injury the patient was evacuated by air to the U.K. and was admitted to this hospital.

At this time his only complaints were of dyspnoea with a feeling of epigastric discomfort after meals. The general condition of the patient was excellent and there was no cyanosis or dyspnoea at rest. He preferred to sleep propped up in bed. There was no tracheal displacement and the apex beat was one inch medial to the nipple line.

There were no abnormal physical signs in the right chest. There was diminished respiratory movement on the left, and the apex was resonant and the lower half of the chest hyper-resonant. Air entry was poor at the apex and absent in the lower two-thirds of the chest. Bowel sounds were heard over nearly the whole of the anterior part of the left chest and in the left axilla.

The heart sounds were normal and the blood-pressure was 110/90. The blood-count showed R.B.C. = 4.5 million. Hb. 87 per cent.

There were no abnormal physical signs in the abdomen. The barium meal was repeated and showed evidence of the stomach and the transverse colon in the left pleural cavity (see fig. 1).

Fig. 1 shows the high level of the diaphragm. Above it lies the air bubble in the fundus of the stomach and above that the air bubble in the colon:

Note how the duodenal spill outlines the first part of the duodenum, which, because it is mobile is dragged over to the left. The non-mobile second part remains on the right side.

Fig. 2 shows the left half of the transverse colon herniated into the chest

and shows the hepatic flexure dragged to the left. It also shows barium residue in the œsophagus, the stomach, the duodenum and the herniated jejunum following the transverse colon into the chest.

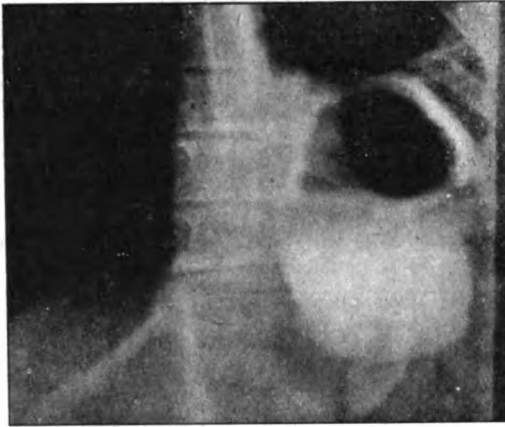


FIG. 1.

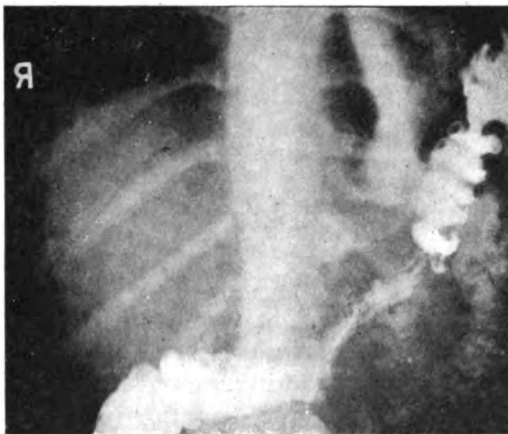


FIG. 2.

He was allowed to settle down in the ward after his air journey and twenty-seven days after his injury he was submitted to operation.

The patient was grouped and cross matched for intravenous therapy during the operation.

A Ryle's tube was passed, in the ward before operation, through the previously cocaineized left nostril.

Premedication was opoidine $\frac{1}{3}$ gr. and scopolamine 1/150 gr. given by H.I. one and a quarter hours before operation.

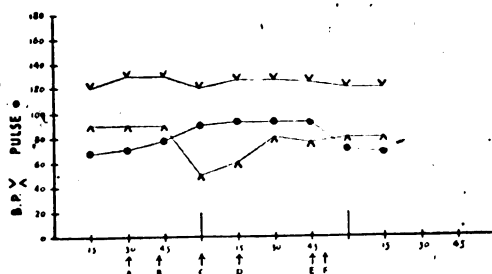
ANÆSTHETIC TECHNIQUE.

A small dose of pentothal 0.3 grm. was given intravenously followed by cyclopropane and oxygen in closed circuit. A No. 10 Magill tube, lubricated with 10 per cent nupercaine ointment, was introduced orally under direct vision and connected to the closed circuit by means of a Cobb's connector. The circuit was made airtight by plugging the nostrils with wool and sealing the lips with elastoplast, no pharyngeal pack being used.

Intravenous glucose saline was set up before the operation commenced.

Blood-pressure and pulse readings were taken and charted every fifteen minutes during operation. Continuous stomach suction was maintained throughout.

At the point of closing the diaphragmatic tear the anæsthesia was deepened and controlled respiration was used in order that movement of the diaphragm should interfere as little as possible with the operative repair. After closure of the tear anæsthesia was lightened.



A. Opn. commenced. B. Pleura opened. C. Replacing viscera. D. Repairing tear.
E. Closing pleura. F. Lung inflated under pressure.

It will be seen from the chart, that the systolic pressure maintained an even level throughout operation, but that a marked fall of diastolic pressure, and a moderate rise of pulse-rate, occurred during the replacement of the gut into the abdominal cavity and the repair of the diaphragmatic tear; these gradually returned to normal.

As the pleura was closed the lungs were inflated with oxygen under pressure, in order that a minimal pneumothorax should be left.

The patient's condition during operation remained satisfactory. The total intravenous therapy consisted of one pint of glucose saline during operation followed by one pint of blood at the end of operation and post-operatively.

The patient regained reflexes very shortly after his return to the ward.

The post-operative instructions were that the patient was to be nursed in the sitting position with the left side of the chest uppermost and that he was to

be given inhalations of 5 per cent CO₂ and 95 per cent O₂ for five minutes, four-hourly for forty-eight hours. The Ryle's tube was left in situ.

OPERATIVE TECHNIQUE.

The patient was placed on his right side with a pillow under his right chest and the left arm on an arm rest. The chest was opened by left oblique incision over the 7th rib, which was excised for a distance of five inches, commencing from the neck of the rib. The pleural cavity was then opened and rib retractors inserted. The cavity was found to contain nearly all the stomach, the spleen, the transverse colon, the greater omentum and about two feet of the jejunum, all without peritoneal covering.

Reduction was difficult and although continuous gastric suction was maintained during the operation, the stomach could not be deflated because the Ryle's tube remained sub-diaphragmatic and did not empty the supra-diaphragmatic portion of the stomach.

However, by continuous pressure, part of the stomach was reduced and the stomach gradually became deflated. Thereafter reduction of all the abdominal contents was relatively simple.

The rent could now be clearly visualized and consisted of, first, an avulsion of the origin of the left diaphragm from the costal cartilages and the sternum. This hole was plugged with very adherent omentum which was freed and replaced in the abdomen. Secondly, extending from this point was a linear tear 5 inches long running obliquely, laterally and backward across the diaphragm. It was found that the exposure was not sufficient to repair the defect and the remainder of the 7th rib was removed by dividing the rib at the costochondral junction. The exposure was now excellent.

The diaphragm was practically immobile (controlled respiration) and so the easily seen phrenic nerve did not need pinching or injecting with local anaesthesia. The tear of the diaphragm was repaired in two layers using No. 3 chromic catgut and the avulsed portion of the diaphragm was reattached to the cartilages by mattress sutures through and around the costal cartilages. This latter was the difficult part of the repair.

The lung appeared to be completely collapsed against the spine with multiple small, red, fleshy, non-bleeding adhesions between lung and lung, and lung and pleura. A considerable number were broken down and the chest closed with pericostal sutures and suture of the intercostal muscles and skin without drainage.

Before closure the diaphragm was seen to be working again and as the pleural cavity was closed the lung was inflated with oxygen under pressure.

At the end of the operation (one and a half hours) his general condition was excellent and there was no rise in his pulse-rate or blood-pressure.

PROGRESS.

The day after operation the patient became increasingly dyspnoeic. This was relieved by the aspiration of 300 c.c. of blood-stained fluid; no further aspiration was necessary. On the third post-operative day, air entry was greatly improved

all over the left chest but the patient had an irritating cough. On the fourth day he was tipped over pillows, given vigorous breathing exercises and succeeded in coughing up a considerable amount of sticky sputum. After this the cough rapidly improved and the patient's condition was sufficiently satisfactory to allow him to get up on the tenth day. An X-ray taken on the fourth day showed no pneumothorax and almost complete re-expansion of the lung with a small effusion in the left costophrenic angle.

He was examined prior to demobilization, Category B, three months later. The lung appeared to have fully expanded and the diaphragmatic movement appeared normal. These findings were confirmed on X-ray examination. There was slight respiratory retraction of the chest wall over the region of the resected rib.

DISCUSSION.

Woolsey divides diaphragmatic hernia into three groups:—

(1) *Congenital*.—There is incomplete fusion of the primitive components of the diaphragm leaving defects which occur on each side posteriorly at the foramina of Bockdalek, or anteriorly in the parasternal region at the foramina of Morgagni. The defect involves the peritoneum as well, therefore there is no hernial sac. Rarely the whole left diaphragm is absent.

(2) *Acquired* via a lax oesophageal hiatus. The para-oesophageal hernia is covered with a true sac of peritoneum.

(3) *Traumatic*.—This is nearly always on the left side because the right side is protected by the liver. The cause is either a missile wound or a bursting effect from a sudden increase of intra-abdominal pressure. There is no hernial sac.

The symptoms of traumatic diaphragmatic hernia are initially those of severe shock due to the trauma causing the herniation and associated with dyspnoea and cyanosis and with a high respiratory rate due to embarrassment of the mediastinum and the lung by the herniation of abdominal viscera into the pleural cavity.

Hæmatemesis is from pinching of the imprisoned stomach vessels. The diagnosis is made by hearing bowel sounds in the chest, by a straight X-ray showing a high diaphragm and a gas bubbling of the stomach or colon above the diaphragm (see fig. 3) and is established with a barium follow through.

Traumatic hernias may not betray themselves for many years after the initial injury and give rise to varied symptom complexes, simulating for example coronary disease, peptic ulcer, gall-bladder dyspepsia or subacute intestinal obstruction. High acute intestinal obstruction may occur and the condition may only be diagnosed at post-mortem. Polson describes a man wounded in 1917 who developed acute and fatal high intestinal obstruction suddenly twelve and a half years later. The post-mortem showed an acute strangulation in a traumatic diaphragmatic hernia. Abdominal viscera are liable to disease whether they occupy the abdomen or the pleural cavity.

Thus peptic ulcer with all its complications can occur in a stomach herniated into a pleural cavity.

Frank and Hamilton describe a penetrating ulcer of the herniated stomach and its surgical treatment via the thoracic approach.

The danger of traumatic diaphragmatic hernia is obstruction or strangulation and the treatment is therefore surgical. This is imperative if the bowel is herniated for, if obstruction does occur, the operative mortality is high.

In the literature the surgical approach to diaphragmatic hernia is disputed. Thus Woolsey thinks the parasternal and most of the hiatus herniæ are best approached from the abdomen. When many thick adhesions are present the thoracic approach appears to offer the best means of direct attack. At times a combined attack may be necessary.

Boyce states "the thoracic approach is best for the repair of the diaphragm but it is not so good for breaking up adhesions in old cases." He advises the abdominal route when the bowel is strangulated or perforated. He describes

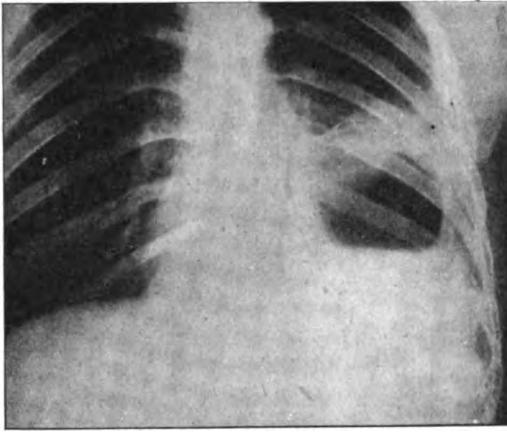


FIG. 3.

a combined route which eliminates the disadvantages of both without adding to the trauma. He makes an incision in the eighth intercostal space commencing at the mid-axillary line across the costal margin on to the abdomen which is opened for $3\frac{1}{2}$ inches. After the chest is opened he cuts across the costal cartilages and thus opens both cavities with a single incision.

Harrington prefers to work from the abdomen in most cases but Hedblom found fewer recurrences and a lower mortality rate in the thoracic approach.

Vere Nichol and Swinney in their cases of traumatic diaphragmatic hernia used the thoracic approach by an intercostal incision, and divided the ribs above and below as far posteriorly as possible.

Although the approach might be disputed in the literature which is predominately American, Tudor Edwards was emphatic that the transpleural route was best except for herniæ via a lax œsophageal hiatus for which he advised the abdominal approach. He stated a combined laparo-thoracotomy

approach is never necessary. For a major thoracotomy he used the long intercostal incisions with division of the neighbouring rib necks.

SUMMARY.

- (1) A patient suffering from traumatic diaphragmatic hernia is described.
- (2) The thoracic approach by resecting a rib was used. Only when most of the rib up to the costochondral junction was removed was exposure excellent.
- (3) Skilled anæsthesia is essential.
- (4) Briefly diaphragmatic hernia in general is discussed.

I have to thank my anæsthetist, Major Miss K. M. Watson, D.A., R.A.M.C., for the anæsthetic details and the chart.

This case is published with kind permission of Colonel A. R. Oram, O.B.E., M.C., Officer Commanding this Hospital.

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Clinical and Other Notes.

PENICILLIN IN THE TREATMENT OF HUMAN ANTHRAX.

BY

Captain G. N. MANN.

DETAILED records of cases of human anthrax treated with penicillin alone are not numerous in the English literature. Below is given an account of a case treated in this way at a military hospital in Palestine.

CASE NOTE.

A soldier aged 19 was admitted with an inflammatory lesion on the left side of his neck. This had started ninety-six hours earlier as a pimple that progressively worsened despite hot local applications and sulphadiazine. On admission the patient looked ill and had a temperature of 104° F. The left side of his neck and face was red, tender and extremely swollen. In the centre of the swelling was a ring of bullæ surrounding a tough, black eschar. Smears from the eschar showed small numbers of organisms resembling *B. anthracis*. Intramuscular penicillin was started in doses of 20,000 units three-hourly. After eighteen hours there was a noticeable general improvement. The temperature was 100.6° F. and the local swelling had receded visibly. Forty-eight hours after starting treatment the patient was afebrile and apparently quite well. All redness and swelling had gone and only a black slough remained, which separated on the tenth day. The total of penicillin given was 2 mega units.

From swabs taken on admission an organism was isolated with the morphological, cultural and biochemical characteristics of *B. anthracis*. The penicillin sensitivity was about 0.6 compared with the Oxford staphylococcus. Inoculation of a guinea-pig proved fatal in eighteen hours, with post-mortem findings characteristic of anthrax.

Penicillin has been shown experimentally to be capable of curing anthrax in a variety of laboratory animals. Heilman and Herrell [1] showed that anthrax in mice could be cured, provided that penicillin treatment was started within twelve hours of infection. Sterne [2] found that guinea-pigs could also be protected, and showed that sulphadiazine and sulphamerazine were much less effective than penicillin. Schabel, Reames and Housewright [3] confirmed the effectiveness of penicillin against anthrax in mice, and demonstrated similar results with rabbits and monkeys. Treatment of monkeys was still successful even if delayed for forty-eight hours after infection. Miller *et al.* [4], using mice, showed that penicillin and streptomycin were both highly effective, whereas sulphadiazine scarcely influenced mortality at all. The sensitivity of *B. anthracis* to penicillin *in vitro* is reported as varying considerably. Fleming [5] reported one strain with a sensitivity 1/40 that of the average for four strains of staphylococcus. Abraham *et al.* [6] describe a strain having the same sensitivity as the staphylococcus. Bondi and Dietz [7] found a strain with a sensitivity of 1/10, stating that growth was inhibited by 0.5 unit penicillin per c.c. Murphy, La Boccetta and Lockwood [8], in their account of three human cases of anthrax, state that one of their strains had a penicillin sensitivity of 1/100, corresponding to complete inhibition by 2.5 units of penicillin per c.c.

Schabel *et al.* [3] state that the concentration of penicillin needed to inhibit growth may lie between 0.02 unit per c.c. and 2.5 units per c.c.

Of the cases of human anthrax already recorded as having been treated with penicillin, a number also had other treatment likely to have influenced the course of the disease. In 1944 Murphy *et al.* [8] reported three cases bacteriologically proven. Duration before treatment was from three to five days. Intramuscular penicillin produced rapid cure, clinical improvement being noted after twelve to eighteen hours and the lesions rid of anthrax bacilli in one to two days.

The authors recommend giving 100,000 units over twenty-four hours for two to four days. In 1945 Stott [9] reported cure in a man of 70 with a five-day-old malignant pustule of the neck. Ten thousand units were given three-hourly to a total of 200,000 units and improvement appeared in sixteen hours. Perl [10], Ahmad [11] and Abrahams [12] describe cases in which penicillin appeared to be effective, but had been combined with arsenic, sulphonamide or serum therapy. In the same year the American Medical Association [13] listed anthrax as a condition responding to systemic penicillin. Smyth [14], reviewing the treatment of anthrax in 1946, refers to thirteen cases known through personal communications to have been treated successfully with penicillin. Details of four cases are given, in which 15,000 units of penicillin were given three-hourly. Smears from the lesions showed no *B. anthracis* after twenty-four hours and cultures were negative on the fourth day. The same author also mentions a series of 112 cases treated by arsenicals with no fatalities and adds a table comparing mortality rates for various modes of treatment.

Treatment		No. of cases	Mortality rate per cent
Nil	.. ..	25	88.0
Non-specific	.. ..	60	28.3
Serum	.. ..	519	8.6
Sulphonamides	.. ..	64	4.7
Arsenic	.. ..	62	0
Serum + Arsenic	.. ..	72	8.3
Serum + Sulphonamide	.. ..	32	9.4

The most conclusive account is that of Ellingson *et al.* [15] who report in detail upon 25 cases of proven human anthrax, 22 of whom received penicillin alone. The majority of cases were seen about seventy-two hours after onset; in 3 *B. anthracis* was isolated by blood culture before treatment. The dosage employed was 60,000 units three-hourly for 5 doses and thereafter 30,000 units three-hourly till the following criteria were satisfied:—

- (i) Diminution of œdema.
- (ii) Cultures for *B. anthracis* negative.
- (iii) Systemic symptoms relieved.
- (iv) Drying of local lesion.

DISCUSSION.—Penicillin is now of proven value in the treatment of human anthrax, and there would appear to be little use in combining with it any of the sulphonamides. In view of the wide variations in penicillin sensitivity

among strains of *B. anthracis* this should be tested as early as possible in order that arsenic may be used if a resistant strain is encountered. In this connexion Bondi and Dietz [7] produced evidence of the formation of a penicillinase by *B. anthracis*.

I have to thank Colonel W. H. O'Riordan, M.C., R.A.M.C., for permission to forward this case for publication.

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THE KUPAT HOLIM.

BY

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It is thought that a brief account of the system of medical attention which is available for a large proportion of the Jewish population in Palestine will be of interest, particularly in view of the approaching advent of State Medicine.

The Kupat Holim is a Jewish organization, which controls the Sick Insurance Fund providing medical attention for about 300,000 people. This is half the Jewish population of Palestine. It derives its income from the Histadruth, which is a combination of the Jewish Trades Unions, and the only one in the country.

I am informed that the Histadruth pays a monthly subscription for each of its members to the Kupat Holim. The amount paid varies from half a crown for an unemployed person to twenty-four shillings maximum, and is based on a sliding scale in accordance with the wages of the individual. The scheme includes not only the worker, but also his or her family. The Kupat Holim receives no financial assistance, or interference, from the State.

As the Kupat Holim relies on the Histadruth for its funds, and the latter relies on the former to restore its members to active work as soon as possible, it

is to their mutual benefit that they should work together in very close liaison. Therefore, the funds supplied by the Histadruth are sufficient to provide a good medical service, whilst the Kupat Holim has the facilities to return the member to active work with as little delay as possible.

Recently, I had the privilege of seeing how the Kupat Holim worked, and I was most impressed with its methods and achievements. It must be remembered that the Jewish medical organization in Palestine is very young, and cannot be expected to have the facilities which have grown up in Europe over the years. Also, owing to political activities in Central Europe during the last few years, many doctors of outstanding merit have come to Palestine. So much so that the proportion of Jewish doctors to potential Jewish patients is in the region of 1:250. In England, I believe the figure is something like 1:2,000.

My conducted tour started off in Tel Aviv—the largest all-Jewish city in the world, with a population of some 250,000—at the Headquarters of the Kupat Holim. This is a large modern building, in which the organization is administered, and where its medical supplies are received in bulk, broken down and issued to smaller dispensaries and hospitals in Jewish Settlements, scattered throughout Palestine. Drugs are received from Great Britain and the United States of America; samples of each are taken and analysed to ensure that they are up to the British or American Pharmacopœia standard specification before being broken down or used in dispensing. Also in this building are major laboratory facilities. The organization is efficient and runs very smoothly.

From here we went to a "Dispensary" in Tel Aviv. The nearest equivalent we have to this at home is the Out-Patient Department of a large hospital. It includes specialists in the many and various branches of medicine with very adequate equipment for diagnosis and treatment; among the apparatus I saw were X-ray, shock therapy, physiotherapy, cardiography, etc., together with very extensive laboratory facilities.

Our next stop was at the Beilinson Hospital of about 300 beds. This hospital is situated near Petah Tiqva, which is six miles outside Tel Aviv. The hospital buildings are built on rising ground in the open country, and surrounded by a very beautiful garden. It provides facilities for general medical, surgical, gynæcological and maternity cases. It is an extremely busy hospital of a high standard, and has a very large and rapid turnover. One was struck with the number of beds in the wards and rooms which were overcrowded compared with British standards.

We then went to a smaller hospital about twenty miles further away from Tel Aviv. This hospital is reserved for the treatment of acute tuberculosis, and consists of bungalow type buildings, situated in an attractive garden. There are also two open shelters, which are equipped with couches on which the ambulant patients rest for certain definite periods each day. It includes all the usual apparatus for artificial pneumothorax and similar therapeutic measures.

About three miles further on we came to a small Settlement, in which there is a medical installation devoted to the care of chronic and long-term cases. It consists of two houses, a specially built bungalow type ward, and some hutted accommodation. Among the patients here were convalescent polio-

myelitis (an ex-soldier), fractured spine (an ex-A.T.S.), cardiac failure, an inoperable new growth, an excision of bladder, and Parkinson's disease. In very pleasant surroundings, the patients are treated with remedial exercises, including swimming, and occupational therapy.

We returned to Benei Berac, which is close to Petah Tiqva, where the organization has leased two houses in which to accommodate 75 beds for convalescent people. These houses are situated on the top of a hill, from which a magnificent view is obtained of the surrounding country with the Mediterranean Sea in the distance. There is a large room in which concerts, cinema, dancing, and games are available; also, there is ample space in the gardens and on the flat roofs where the patients can sit in the sun.

I was particularly struck with the close union between the Trades Union and its own Medical Service, which should result in maximum medical attention and efficiency, with the minimum scrimshanking on the part of the "patient," and also which includes the whole family in the scheme.

The particular importance placed on attractive surroundings was noticeable; each of the installations is situated in a beautiful garden with trees—many of which are eucalyptus and are regarded as being of marked therapeutic value—flowers of all kinds, and, what is more delightful, good green grass. In a country where the rainfall is not so abundant or prolonged as it is in England, and where most of the water comes from deep wells, the presence of a garden of any sort is no mean achievement.

The stress placed on occupational therapy and rehabilitation was most marked. Welfare includes wireless, games, music, cinema and lectures. The Jewish people take a much greater interest in talks, both wireless and given by lecturers, than is the case among our own people.

The number of beds accommodated in the wards is much greater than that to which we are accustomed; but the number of patients far exceeds the number of available beds, and therefore no other choice is possible until more hospitals can be built. As an indication of the cost of equipping and maintaining a hospital, I was told that it costs £1,000 a bed to build, and £2 per day to maintain a bed in an existing hospital. Before the last war, the latter figure was six shillings.

During my visit I was greeted with the utmost cordiality, and had the pleasure of meeting a number of eminent men of our profession, which included a former Professor of Surgery in Berlin, and one who had held a similar chair in Dermatology in Vienna. I was impressed with the losses that Europe has sustained to the inestimable gain of Palestine.

MARTIAL LAW IN TEL AVIV.

BY

Colonel K. FLETCHER-BARRETT, O.B.E., M.B., F.R.C.S.

MARTIAL LAW came into force in certain areas of Palestine at 1.15 p.m. on March 2, 1947. The areas affected were Jerusalem and Tel Aviv; it is from experiences in the latter area that this account is given.

In order to appreciate what occurred it is desirable to know what Martial Law implies. Briefly, it means that the Military Commander, in this case the G.O.C. 1st Infantry Division, becomes responsible for all that happens within the area under Martial Law. The most important factors are the purely military operations and the continuance of the Civilian Administration, as far as this is possible, when subordinated to the exigencies of the military requirements.

Before referring to the problems directly or remotely connected with medicine it is necessary to give an outline of general matters which affect the plan and its execution.

The population of Palestine is approximately 1,000,000 Arabs, 600,000 Jews, and 100,000 Christians. The area in which occurred the events to be described consisted of Tel Aviv, Ramat Gan, Benei Berac, and Petah Tiqva. The area is practically entirely Jewish, and includes a population of some 300,000 people. That is to say that approximately half the Jewish population of Palestine was involved in the operation. Tel Aviv is a densely populated Jewish city—the largest all-Jewish city in the world—continuous with and to the north of the Arab city of Jaffa.

It is not proposed to refer in detail to the Government Medical Service, which is part of the Public Health Department of Palestine, as this account is written mainly from the Military point of view. Therefore, the Government Service will be referred to only, in so far as is necessary, to appreciate its effects on the military commitments.

The system of medicine, as practised by Jewish doctors here, differs in many respects from that to which we are accustomed at home. The proportion of doctors, among the Jewish population, is in the region of 1:250; in the United Kingdom it is more like 1:2,000. In Palestine, Jewish doctors have subdivided medicine into a far greater number of specialities, e.g. Cardiology, Internal Diseases, External Diseases, Blood Diseases, etc., than is the custom at home; also, quite a fair proportion of these doctors conduct their own private hospitals, each of which contains a varying number of beds devoted to the doctor's particular speciality. Such hospitals do not compare in size or in the wide range of ailments which are treated in nursing homes and in hospitals in Great Britain. In addition to these private hospitals there are bigger general hospitals, such as the Hadassah (380 beds), the Assuta (180 beds), the Government hospitals in Tel Aviv, Kiriya Arabiye, Jaffa, Benei Berac (infectious), and the Beilinson (largely maternity) in the Petah Tiqva region.

At first sight the proportion of Jewish doctors may appear to be remarkable, but this is readily appreciated when it is remembered that for many years it has been the policy in several European countries to harass the Jews, particularly those of the higher standards of intelligence, so that they have been forced to leave their homelands to find sanctuary elsewhere. It is among these people that one finds scientists of all kinds, many of whom are of international repute.

In addition there is a Sick Insurance Scheme—the Kupat Holim—which provides for treatment in dispensaries, which are situated in Jewish Communities

throughout Palestine. The Headquarters and main distribution centre for drugs, etc., of this organization is in Tel Aviv. The Kupat Holim includes doctors, dentists, nurses, and pharmacists. The size of this organization can be estimated by the fact that 35 passes to cross the cordon were required for its essential employees.

Civilian ambulance cars are provided by the Margen David Adom (Red Shield) Ambulance Society, an organization which I believe is largely financed by voluntary contributions. The Society's cars are painted white and bear the insignia of the Star of David outlined in red. In the early days of the operation it was not realized by all troops that this insignia is the Jewish equivalent of the Red Cross, which resulted in several of these cars being refused free passage. A similar situation might occur in the case of the Mohammedans, who use the Red Crescent for the same purpose.

The object of the operation was to effect the arrest of those engaged in subversive activities in defiance of the Civil Government and the Law. The basis of the plan was that a cordon would be thrown round the area, to include Petah Tiqva, Benei Berac, Ramat Gan, and Tel Aviv. Within this cordon the Civil Police, assisted if necessary by the Army, would conduct searches and arrest anybody suspected of illegal activities. Law-abiding persons would go about their affairs to the best of their ability. The cordon was to be as far as possible absolute, only those essential vehicles and persons required to maintain essential civilian services would be permitted to pass either way through the cordon, or to move in the city of Tel Aviv, except on foot. The cordon area would be isolated from the remainder of the world, in so far as rail, road, telephones, telegraphs, post and any other form of communications were concerned.

The execution of the plan involved the imposition of a total curfew, which it was anticipated might last for thirty-six hours, but actually was lifted after five hours, during which the troops forming the cordon would get into position and erect their obstacles and defences.

My Commander defined the objects of the operation as: "To paralyse and, if possible, eradicate the cells of evil which are known to have their roots in Tel Aviv and its suburbs. It is not instituted as a punishment to the people. The enormous dislocation to normal life, resulting from the complete cutting off of so large an area from the outer world, was an inevitable part of the price that had to be paid for the operation. In order to avoid a state of chaos, it was most desirable that local municipal government and essential services should be left as free as possible, but, of course, only within the G.O.C.s term of reference."

It was fully realized, however, that there would be considerable dislocation of business activities, not only within the area but also in the rest of Palestine, because Tel Aviv is the city from which most of the Jewish business is conducted.

Consideration of the factors already mentioned resolved the medical problem mainly into one of communications—road and telephone—together with the maintenance of very close liaison with the Senior Medical Officer, Public Health Department, to ensure the earliest possible action in the event of a breakdown of the civilian medical services, or the outbreak of epidemic disease.

It was immediately obvious that the medical resources of a Division could not possibly care for the medical commitments of a population of 300,000, nor was this desirable, as stressed in the Commander's instructions. Therefore it was essential to ensure that the Jewish doctors should be able to continue to care for their own people. There was never any suggestion on their part that they would not do so, but, as will be seen later, difficulty arose in the provision of transport for them, as all motor traffic, other than essential, was prohibited within the cordoned area. Moreover, there was no civilian telephone communication in the early days. The high proportion of doctors to prospective patients made it certain that no sick Jewish person would be beyond walking distance of a doctor. Either the patient could walk to the doctor or vice versa. The minimum number of essential doctors, e.g. surgeons, obstetricians, etc., on the staffs of the bigger hospitals were issued with special passes for themselves and their cars. Here it should be mentioned that in Palestine relatively few mid-wifery cases are conducted in Jewish patients' homes, the mothers are admitted to hospital whenever this can be done.

The preliminary planning included the civilian and the military elements. Brief reference will be made to each separately.

Civilian.—Some time previously the majority of British women and children were evacuated from Palestine. A few women, whose retention in the country was considered to be necessary, remained behind. These, together with the other essential British civilians, including those of the Civil Government Administration, were segregated into protected Cantonments. In the area under consideration, one Cantonment was based on Citrus House in Tel Aviv, and a second on the Jaffa Police Station area. At Citrus House there was one battalion, whilst the Jaffa Police Station became operational Headquarters. The Civilian Administrative Officers were housed in the District Commissioner's Office, which was in the Police Station area.

Military.—The cordon was found by a Brigade with additional troops under command, the Brigadier being in immediate operational command. A Military Liaison Office was set up at Jaffa Police Station to co-ordinate the functioning of the essential civilian services with the military operation.

The medical resources consisted of one Regimental Medical Officer, with one ambulance car attached to each battalion or equivalent Unit, the British Military Hospital, Bir Ya'acov; No. 3 R.A.F. Hospital, Tel Litwinsky; with six additional ambulance cars at the latter. The Regimental Aid Post at Citrus House was augmented by one section of No. 2 Field Ambulance, and two ambulance cars.

Sequence of Events.—During the night of March 1/2, 1947, a complete curfew, which lasted from midnight March 1 to 0500 hours March 2, was proclaimed in Tel Aviv. This was to enable the cordon to be established.

On March 4 difficulty was being experienced in passing patients through the cordon. These included patients discharged from hospitals in Tel Aviv to be returned to their homes outside the cordon, and out-patients requiring treatment, e.g. pneumothoraces, ambulant fractures in plasters, and those requiring radium treatment, which is available in Jerusalem only. To compete

with these, one Troop Carrying Vehicle and two ambulance cars were placed at the disposal of A/Q at Operational H.Q. in the Jaffa Police Station. A similar situation arose at main Brigade H.Q., which was located outside the cordon, and which rapidly became besieged by patients trying to get into hospitals in Tel Aviv. These included urgent sick and women in labour. Two ambulance cars were attached to this Headquarters.

It became more obvious that the success of the operation, from the medical point of view, would depend upon the continued assistance of the Jewish doctors within the cordon. This necessitated the issue of an increased number of passes for vehicles and persons to move within and through the cordon.

On March 6 I attended the Food Control Conference at which it was established that the food supplies were adequate in quantity and quality, with particular reference to those required for children and nursing mothers. Fear was expressed that there might be an excessive purchasing of tinned food, with a consequent creation of a black market, but this did not materialize. At 0600 hours on this day, the automatic telephone exchange was reopened for general use, which greatly facilitated the working of the civilian services.

On March 7 I called a conference of representative Jewish doctors in Tel Aviv. Among those who attended were the Deputy Director, Hadassah Hospital, the President, Kupat Holim, the M.O. Settlements, the Secretary, Margen David Ambulance Society, a representative of the Jewish Medical Association, and the S.M.O., Tel Aviv, with his Assistant S.M.O. From this meeting the impression was gained that the Jewish doctors were most willing to ensure that no Jewish person would suffer from lack of medical attention.

I was assured that the supply situation, particularly as regards food and medical stores, was satisfactory, that there was no epidemic disease, also that there were no matters of hygiene or sanitation to note. Later it was discovered that the garbage from a small area in Tel Aviv, and a larger one without the cordon, was not being cleared satisfactorily. This was due partly to passes for vehicles and scavengers not having been demanded, and partly to an argument having developed as to whether the financial responsibility was that of the Municipality of Jaffa or of that of Tel Aviv. In the meantime, large piles of garbage had accumulated! Orders were issued for these passes to be issued and the refuse to be removed immediately. This was done.

The main complaint of the Jewish doctors was that they were unable to use their private cars. It was represented that there were many ex-British Service doctors who were in the process of rebuilding their practices, and that in the absence of transport facilities they would be heavily penalized. It was explained that these conditions applied equally to other ex-Service men, e.g. dock workers, who had no work at all, and that passes for individuals and vehicles would be issued only to those considered essential to maintain the bigger hospital services at this stage in the operation. These essential physicians and surgeons had been issued with passes. The question of doctors being immobilized by a curfew was raised. Fortunately the curfew, in this operation, had not lasted long enough to cause any serious inconvenience; but it was agreed that some method should be devised to permit approved doctors to move during a curfew.

I was particularly impressed by the cordial reception given to me at this meeting, and by the fact that the Jewish doctors put no obstacles in our way.

On March 8 I was appointed a member of the Civil Advisory Council, the functions of which were to ensure that the gaps in the civilian administration were filled in, and to make immediate decisions in matters which did not require the Military Commander's instructions. The S.M.O. was also a member of this Council.

The S.M.O. had been engaged to a large extent on clerical duties in connection with the recommendation and issue of passes, etc. To permit him to devote more attention to preventative medicine, a Military Medical Liaison Officer was appointed to work with him.

On March 17 at 1200 hours Martial Law was raised and conditions reverted to normal.

From experience of this operation it was found that the following matters merit consideration, whenever a similar operation is envisaged again. It is of utmost importance that constant liaison is maintained between the A.D.M.S. and the S.M.O.

Nominal rolls of persons and vehicles, which are essential for the continuance of the hospital services, must be prepared, checked for security, and kept up to date by the S.M.O. This must be done in sufficient time to allow of the preparation of passes, so that they may be available for issue immediately the operation commences. To be included in these must be doctors, dentists, nurses, midwives, ambulance drivers, pharmacists, hospital employees, purveyors of hospital supplies (including food, laundry and possibly fuel), municipal employees to remove garbage, municipal carts, ambulance cars and hearses.

Seventy doctors, nurses and technicians were out of Tel Aviv when the operation commenced. They were away for the week-end. Therefore permits must be available for such as these, so that they can return to their homes and work.

The number of passes issued on the recommendation of the S.M.O. will depend upon the size of the area involved, and may run into several hundreds. Permanent curfew passes should always be in the possession of approved doctors. The doctor's Licence to Practise, or Identity Card, suitably endorsed and stamped by the Security Authorities, would serve this purpose. If necessary these could be renewed and revised at stated intervals.

Vehicles must be made available to transport patients from hospitals back to their homes; also for out-patients to pass through the cordon either way. In this connexion it must be remembered that such people are convalescent or sick, and that they cannot be kept hanging around waiting for screening, passes, etc.

To facilitate the issue of passes for out-patients it is suggested that the doctor in charge of the case should submit an application for a pass to the S.M.O. giving all details. Alternatively, the situation could be met with greater security by the establishment of a screening centre on one road where it crosses the cordon, and by which all such traffic will enter and leave the area. Such a Centre would have to be provided with a suitable waiting-room, furnished with an adequate number of chairs.

Essential civilian ambulance cars must be provided with suitable passes to permit free circulation within and through the cordon. These must have the highest priority.

A list of essential telephone communications, in order of priority, should be maintained in the Public Health Department; if possible, a line to the Infectious Hospital should be included. Also there should be an Enquiry Operator in the exchange, who will be able to advise a subscriber whether it is possible to get a required number by some alternative routing, and if so how to go about it. It is understood that on an automatic exchange it is impossible for technical reasons to disconnect an individual subscriber, apart from removing the instrument from his house. It is impracticable to remove the instruments from thousands of citizens; therefore, if the normal telephone facilities are not available, some alternative form of rapid intercommunication must be established. This is essential if effective action is to be taken rapidly to control epidemic disease.

The Coroner must be able to function from the commencement of the operation, as also must be the authority responsible for the issue of burial certificates. As this was not realized at the beginning, twelve bodies awaiting burial had accumulated in one hospital within the first twenty-four hours. Fortunately, the weather at the time was not hot, but in hot climates this matter is of particular importance. If the military situation can possibly permit it is advisable that the burial grounds of each race involved, also the Municipal refuse dumps, should be included within the cordon. This would obviate the necessity for passes and the delay occasioned by passing through the cordon.

The strictest attention must be paid to hygiene and sanitation, not only by the Civilian Authorities but also by the Military. The S.M.O. must devote a large proportion of his time to preventive medicine and hygiene.

The health of the troops remained excellent throughout the operation and there was no outbreak of disease of an alarming nature among the civilian population. The civilian medical arrangements worked satisfactorily, once the initial difficulties of passes had been overcome. It must be remembered that individual passes are required for both vehicles and for persons.

It will be seen that in operations of this kind the main factor is the issue of passes. It may be extremely difficult to decide what passes should be allowed. People will use great ingenuity in getting through a cordon, and will support their requests for passes with any reason remotely connected with medicine. As an instance, a request was received for the release of packing materials for pharmaceutical products. As these may include anything from lipsticks to a vital substance such as insulin, one may penalize a patient by the refusal of a permit; alternatively, one may permit the transit of something which is not essential. Again, drugs liable to spoilage—vaccines, penicillin—may accumulate in the docks or in transit sheds and so be ruined.

In conclusion, I would mention that, whilst passes were being prepared, a system of military escorts was used with success. In the same manner it was arranged that a policeman of the Arab or Jewish race would accompany a casualty of his own race in the ambulance car, to ensure that the patient arrived

at the correct Arab or Jewish hospital. The provision of escorts is limited by the number of troops who can be released for such a duty.

I am indebted to Major-General R. N. Gale, *C.B., D.S.O., O.B.E., M.C.*, Commanding 1st Infantry Division, for permission to forward this article for publication.

Notice.

PRIZE COMPETITIONS, 1947.

THE Council of the Royal Sanitary Institute have announced that prizes will be offered during 1947 for competitions on (1) practical improvement of appliances or inventions for dwelling houses, and, (2) atmospheric pollution or the ventilation of buildings and its effect upon human health.

For the first of these essay competitions, the John Edward Worth Prize of £40 is offered. The second competition, which gives a choice of subject this year, will be for the John S. Owens Prize of £25.

The general conditions applicable to the competitions can be obtained from the Secretary of the Royal Sanitary Institute, 90, Buckingham Palace Road, London, S.W.1.

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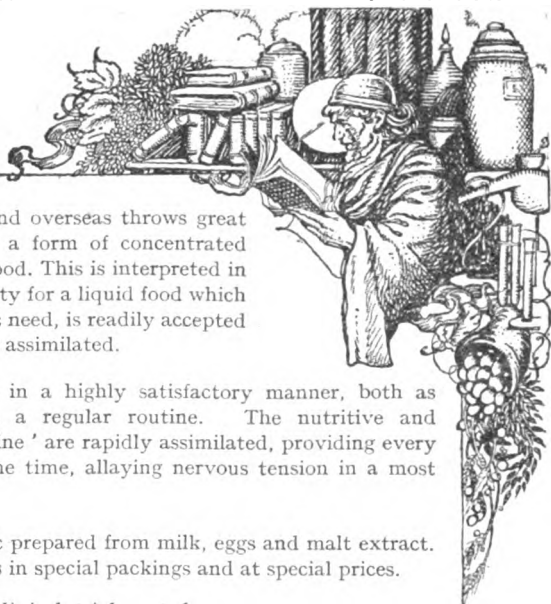
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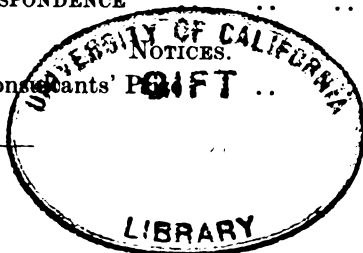
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Journal of the Royal Army Medical Corps.

Original Communications.

ACRYLIC OCULAR PROSTHESIS

BY

FREDERICK J. SELLERS, F.S.M.C.

Serjeant-Optician, Queen Alexandra Military Hospital, Millbank.

[Received July 7, 1947.]

UNTIL a few years ago the only ocular prosthesis available was made in glass and though many people had developed their manufacture to a very high standard, their actual fit, more often than not, left much to be desired.

With the advent of plastics it was soon found that remarkably lifelike eyes could be successfully fabricated from methyl methacrylate plastics. Many technicians have mastered the difficulties of manufacture and to-day the plastic ocular prosthesis is considered to be the best possible.

Stock eyes made up in acrylic can easily be adjusted to fit individual sockets (it is this method that the Ministry of Pensions use for the bulk of their cases), and though this is an obvious improvement in fitting technique, the eye still looks artificial by virtue of the fact that it is immobile.

Much research has been done in this direction and though the taking of a socket impression was found to be relatively simple, using dental impression materials, the fabrication of the necessary prosthesis from the socket mould was a lengthy process, therefore not economical from the time factor, for either patient or practitioner.

For the fabrication of an acrylic prosthesis from a socket mould the writer has evolved a simplified method which is quick and satisfactory for both civil and military needs.

This method has been put forward by the Advisor in Ophthalmology for possible standard use in Army Ophthalmic Centres overseas where it is occasionally necessary to procure an eye for a serving soldier.

For simplification the use of pre-processed acrylic irides are advocated. These are supplied in diameters of 10.5 mm. and 12.5 mm. and in four main colour groups in brown, blue, hazel, and grey. The variety of colours and shades to be found in each group is impossible to describe or catalogue, but from a selection of these it has been found in actual practice possible to obtain a good match for most colours of iris (this applies to Europeans only). Pupil sizes are 3 mm. and 4 mm.

The fabrication of the acrylic eye, by this method can be subdivided into eight stages :—

- (1) Selection of matching iride.
- (2) Zelex impression.
- (3) Preparation of wax model, and fitting to socket.
- (4) Pin pointing and adding of acrylic iride.
- (5) Investment of wax model in flask, and wax washed out.
- (6) Flask re-packed with acrylic.
- (7) Acrylic polished—blood-vessels inscribed.
- (8) Final polish and fit.

SELECTION OF MATCHING IRIDE.

It is considered best to match irides in a fairly bright light, but it must be

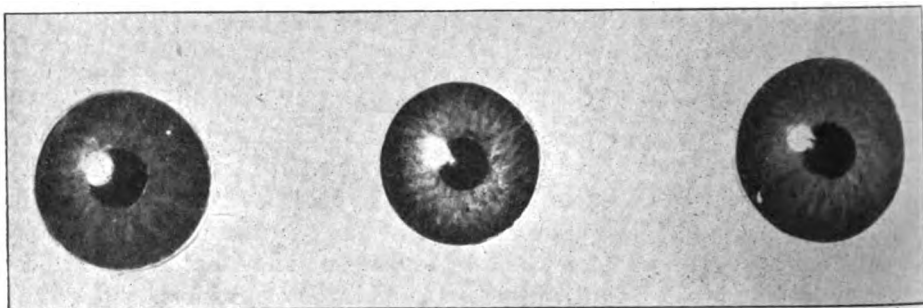


FIG. 1.—Pre-processed acrylic irides.

kept in mind that on examination most patients' pupils seem to be somewhat dilated—possibly due to a nervous reaction.

For a patient who spends most of his day in artificial light, an iride with a large pupil size is preferable.

Pupil sizes of the acrylic irides can be enlarged by carefully scribing a circle of the required diameter on the painted posterior surface and then, with a sharp scraper point, scraping away the paint in the area required, replace the paint with black oil or Indian ink and setting aside to dry for at least forty-eight hours.

SOCKET IMPRESSIONS.

For the satisfactory fabrication of an accurately fitting plastic eye, the most important factor is a knowledge of the shape of the socket to be fitted. This is best achieved by a socket impression. In practice this has been found to be easily obtained using Zelex, a sodium alginate dental impression material marketed by the Dental Manufacturing Company, who include with their Trial Outfit a balance for measuring the quantities (equal parts by weight of water and powder). The following notes are for practitioners not conversant with this impression method.

Prior to the taking of any impression, the socket should be carefully examined for any abrasions or discharges. Should there be extensive discharge, this is a

contra-indication to a successful impression. Even assuming the socket is quite healthy and clean it is advisable to first irrigate with an undine, using a tepid saline solution and generally cleaning the lid margins, a drop of Parolene applied to the socket, lid margins, and lashes, will help to avoid any sticking of the impression material.

A suitable quantity of Zelex is then placed into the measure provided, and balanced by an amount of tepid water. The powder is placed preferably in a rubber mixing bowl and the water added (in practice it has been found that slightly more water by weight than powder produces a more satisfactory impression material).

The mixture is then spatulated against the sides of the rubber bowl for approximately one and a half minutes. The back of a spoon serves a very useful spatula. The Zelex should now be of a thick creamy texture, and should just pour when the mixing bowl is tilted.

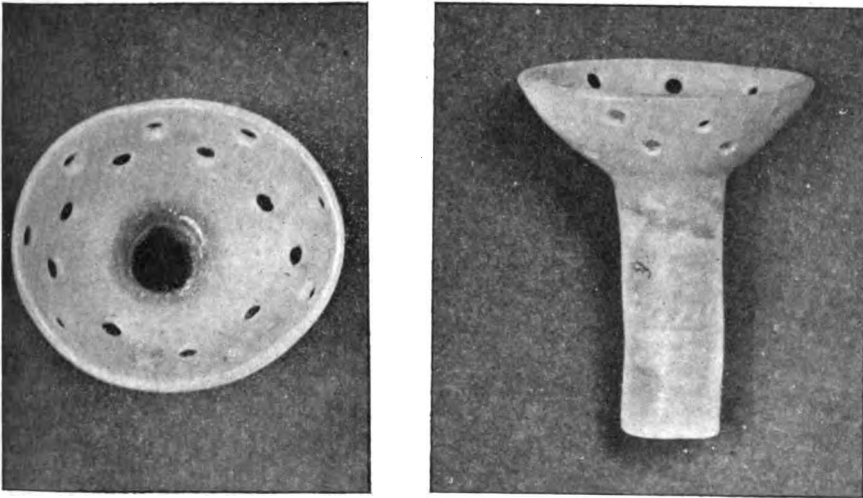


FIG. 2.—Socket impression tray.

A suitable amount is then transferred into the impression tray.

With the patient sitting upright on a couch, the impression tray is inserted in a slightly upward direction under the upper lid, whilst an assistant holds the lower lid down. When the impression tray is in position, the assistant releases the lower lid and the patient relaxes to a supine position and maintains fixation on a suitable target on the ceiling with his good eye.

After three minutes or slightly less, depending on the time spent on mixture and spatulation (the manufacturers state that the total setting time for Zelex is approximately four and a half minutes from the addition of the water to the powder), the tray may be removed from socket. Individual practitioners will discover their own methods for removing the tray as it seems to be a matter of preference from which lid the impression is eased first. Should the tray become detached from the impression it is an easy matter to remove the latter without



FIG. 3.—Mixing of Zelex—Filling impression tray.

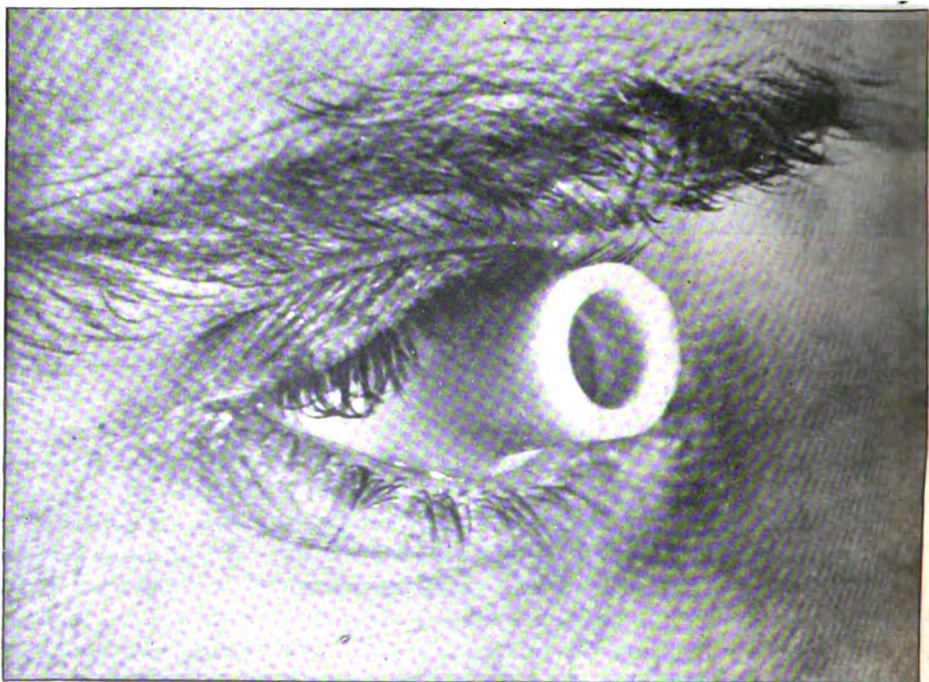


FIG. 4.—Impression tray in socket.

damage with a blunt spatula. The tray is then placed, for safety, in the neck of a small bottle. The assistant can now prepare the plaster for casting.

The socket should be carefully examined for any minute particles of the Zelex. If any are observed, these can easily be removed with a wisp of cotton-wool. (No such cases have been found by the writer.)

The socket should again be irrigated and the lid margins cleaned. As Zelex dehydrates and shrinks very rapidly, it is necessary to cast within a half-hour of taking the impression, and this cast can be made in one-half of the flask used for fabricating the acrylic eye.

When the plaster is dry it is possible, using care, to remove the Zelex impression without damage and to make a further duplicate cast should, by any circumstances, the first cast become damaged.

If the impression is seen to be unsuccessful on removal from the socket, it is quite an easy matter to take a second impression immediately.



FIG. 5.—Making the wax model from the socket impression.

PREPARATION OF THE WAX MODEL.

From the plaster cast of the socket impression it is possible to make a model eye in wax. Royal Army Dental Corps mechanics are very adapt at this and will usually co-operate enthusiastically. This model, polished with cotton-wool and cold water, should be tried in the socket and its "fit" examined. The model should fit well up to the inner canthus. A common fault

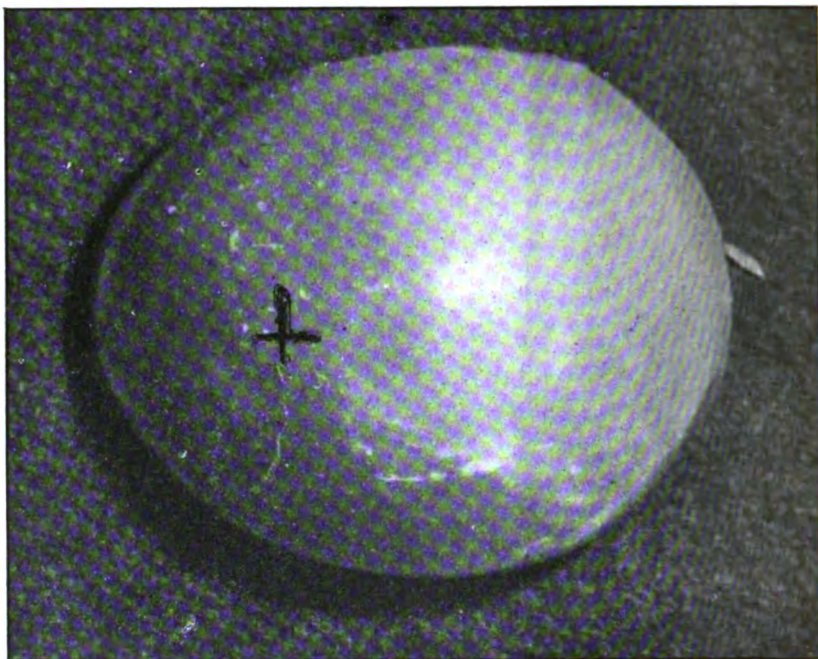


FIG. 6.—Wax model ready to fit to socket as trial.

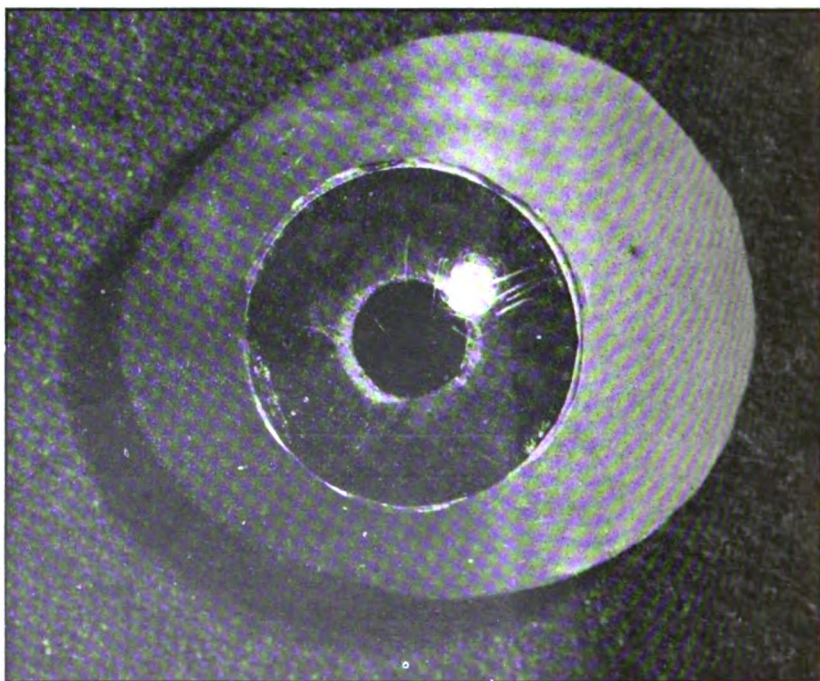


FIG. 7.—Wax model with matching iris fitted.

is found on the patient rotating his eyes upwards when the model tends to ride up and over the lower fornix. This is remedied by decreasing the angle between the back and anterior lower surface (Angle B).

Should this not suffice it will be necessary to remove some of the wax at the back, centrally causing a depression. This will give some suction to the model and is usually satisfactory. If the model still persists in riding up and over the lower fornix, it means that the overall depth of the model is too great and must be reduced.

Points to note about the fit of the model are :—

(1) Palpebral aperture : This should match the other eye exactly and can be made to do so by removing wax from, or adding it to, the anterior surface.

(2) Socket retention of the model whilst the other eye is rotated to all positions.

PIN POINTING AND ADDING OF ACRYLIC IRIDE TO WAX MODEL.

When a satisfactory fit of the wax model has been obtained the patient should direct his gaze to some distant object, and, using a heated probe point, the pupil centre is marked and checked. The model is removed and a circle inscribed on the wax, the diameter of the iris to be used. Sufficient wax is removed from this area to allow the fitting of the iris. This is fixed in position by the addition of molten wax with a heated modelling knife.

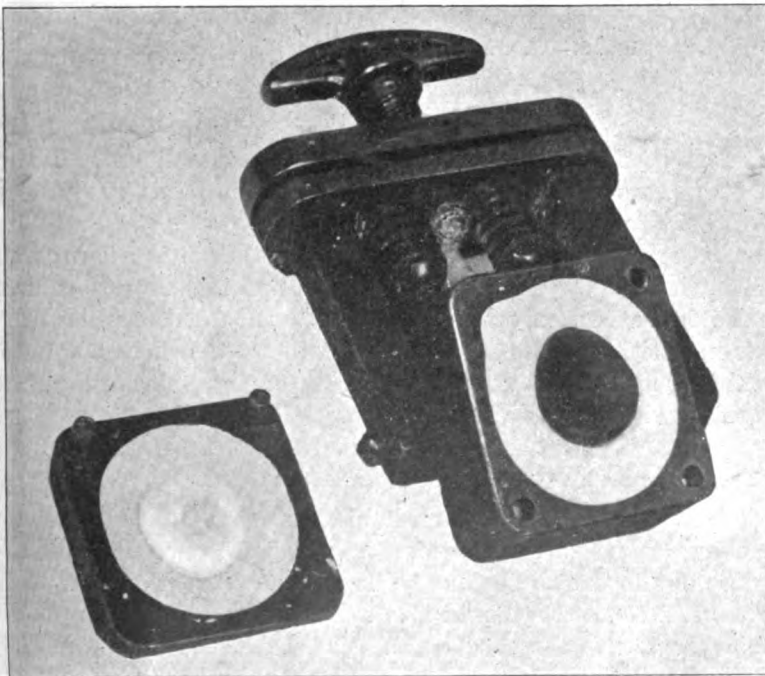


FIG. 8.—Wax model invested in the processing flask.

The model should be repolished and again tried in the socket, the fit and iris position checked—any adjustment necessary made—the wax model now being ready for investment in the flask. It is important that the wax model be fitted properly before any further stage of production is attempted.

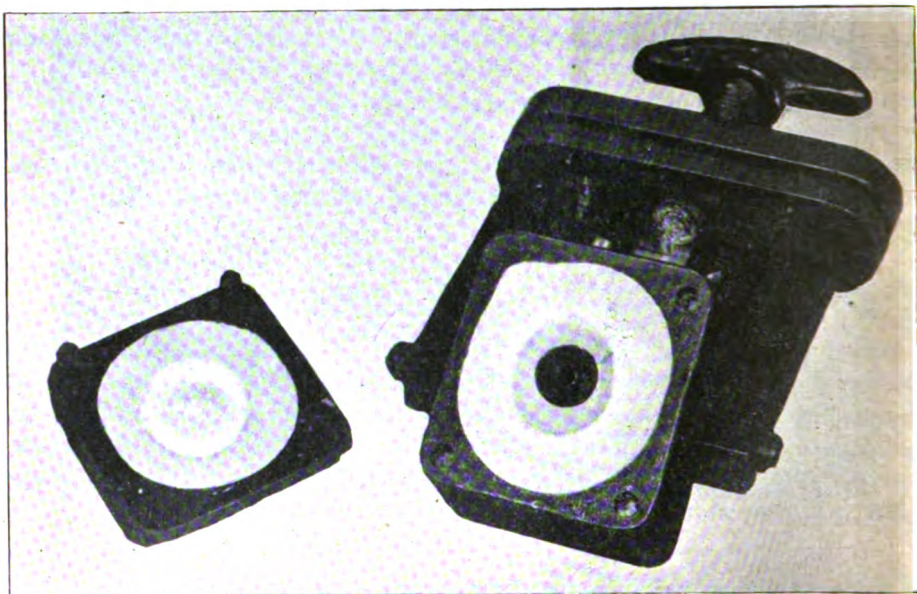


FIG. 9.—Wax washed out—leaving iris in position.

INVESTMENT OF THE MODEL.

Investment of the model, and in fact all the remaining stages, excepting the final fitting, are best completed by a dental mechanic as these processes are part of their stock in trade.

The model is preferably invested iris downwards in the lower half of the flask. When the counter half has been poured and the plaster set quite hard, the wax should be washed out with boiling water; this will leave only the acrylic iris in position. Care must be taken to see this does not become displaced at this or any subsequent stage. All the exposed plaster surfaces should now be coated with *acrylic separating medium*.

PACKING THE FLASK AND PROCESSING.

Acrylic is supplied as powder and liquid which are mixed to form a dough before packing of the flask for processing. Accurate matching of the sclera shade can be obtained by judicious mixing of the powder stains.

Pour about 2 c.c. of the liquid into a small vessel like an egg cup, slowly add the powder until it is just level with the surface of liquid, and agitate the vessel to ensure complete saturation. Stir thoroughly for a few seconds to distribute the pigment evenly, tap the vessel on the bench, cover and allow to

stand for ten to twenty minutes. No free liquid should exist on the surface of the mixture at any stage. If such liquid appears on standing, it must be absorbed by the addition of more powder.

To test the consistency, prod the mixture with a spatula and when it is sticky and no longer flows, it should be thoroughly spatulated until it forms a "dough" and comes away clean from the sides of the vessel. The dough may now be kneaded for a few minutes before packing or, to avoid contamination by unclean hands, it may be spatulated into the flask without kneading or, alternatively, kneaded in cellophane.

Sufficient acrylic dough should be pressed into the lower half to fill it to excess, and the flask closed slowly. The excess acrylic dough will slowly extrude as the flask is closed. The flask should be left to stand for some minutes before the final closing metal to metal of the flask.

To process, place the flask on a non-conductor (e.g. earthenware, glass or porcelain) in a large saucepan of cold water which should be well above the level of the top of the flask, and place on a gas ring. The temperature should not exceed 60 degrees centigrade approx. during the first thirty minutes, after which the water may be brought to the boil. Boiling should continue for at least thirty minutes and prolonged boiling is not harmful.

Allow the flask to cool on the bench to avoid internal strain developing in the acrylic. Rapid cooling in water should be avoided. The flask *must* be quite cold before it is opened.



FIG. 10.—Blood-vessels being inscribed on eye.

ACRYLIC POLISHED—BLOOD-VESSELS INSCRIBED.

Remove the acrylic eye from the flask, taking care not to injure the plaster as it may be required for the fabrication of a spare eye. It will now need to be trimmed, lightly sandpapered where necessary to remove rough patches, and semi-polished on a dental lathe, using pumice and whiting and plenty of water in the brushes.

When semi-polished, the eye is ready for the addition of the blood-vessels as seen in the natural eye. The number, intensity of colour and position will, of course, vary with each eye. The blood-vessels should first be inscribed on the acrylic with a sharp fine pointed knife, or similar tool. Into these fine grooves the colour—oil, water or even red ink—is rubbed, and the excess removed from the sclera. These colours are fixed by painting over them with acrylic solvent or chloroform. Several paintings will be required. The solvent dries within ten to fifteen minutes according to room temperature.

The eye is now ready for the final polishing which should be completed using a very fine whiting and soft buffs.

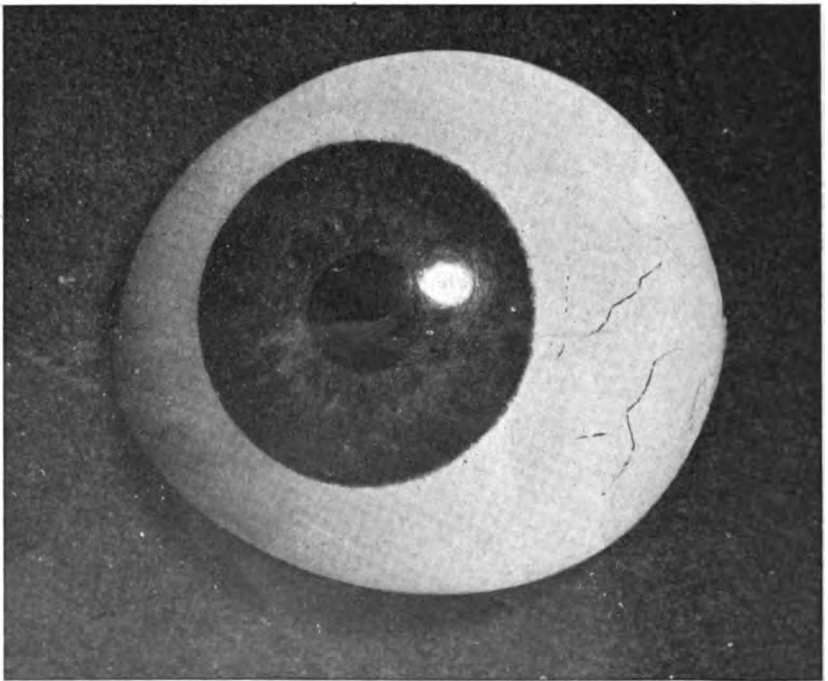


FIG. 11.—Completed acrylic prosthesis.

These stages can be easily completed within six to ten hours and the resultant eye will, in view of the fact that it has intimate contact with the residual muscle tissues of the socket, in most cases give good movement. This movement gives a more realistic appearance than any other factor and is of course a definite step forward from the *immobile* glass or acrylic prosthesis.

THE CHEMOPROPHYLAXIS OF MALARIA.

BY

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INTRODUCTION.

MALARIA is one of the major problems which face the worker in Preventive Medicine in tropical and sub-tropical areas. The geographical distribution is widespread. The economic aspects have been emphasized by many authors. In India, it is estimated that 100 million persons are affected annually, with 1,300,000 deaths. Dramatic epidemics occur such as that in Ceylon in 1935 when 80,000 deaths occurred in seven months. "No accurate estimate can be made of the actual number of deaths from malaria but it is certain that for every person who dies from an actual attack of the disease several others succumb to pneumonia or dysentery against which their resisting powers have been lowered by malaria. Ross suggested that some ancient civilizations such as those of Greece and Ceylon were destroyed by malaria" (Rogers and Megaw, 1935).

The recent war involved the employment of troops in many highly malarious areas and in consequence much large scale work in malaria prevention was carried out. There were two notable advances, one was the use of DDT in mosquito control and the other the large scale use of chemoprophylaxis.

It is proposed, therefore, to discuss chemoprophylaxis with special reference to experience in the recent war. It must, of course, be recognized that this is but one of the weapons at the disposal of the tropical health worker when attacking the problem of the prevention of malaria.

A brief review will be given of the prophylactic use of quinine and plasmoquin. This will be followed by some account of the information available about mepacrine prior to 1939. An account will then be given of some experiences with mepacrine in various theatres of operations during the war.

This will be followed by a brief note on paludrine. Finally an attempt will be made to summarize the lessons of wartime experience, to apply these lessons to possible large scale prophylaxis of civilian populations and to evaluate the place of chemoprophylaxis in the control of malaria.

Quinine.—Cinchona bark was used as a prophylactic by ship's surgeons and in the Colonies in the eighteenth century. Following the isolation of the pure alkaloid in 1831 it began to be used extensively but in a rather haphazard fashion by residents in malarious areas.

There is evidence to show that quinine suppression has produced good results in many areas and enabled Europeans to lead tolerable lives in highly malarious districts. None of this evidence is particularly conclusive. It was used quite extensively on the Macedonian and other fronts in the 1914-1918 War. Opinions as to its value are variable and the Medical History of the

War sums the matter up as follows :—" . . . quinine was extensively used as a prophylactic but there appears to have been no consensus of opinion as to its value. The evidence generally, however, was against the practicability of its use as a prophylactic. . . ."

Hamilton Fairley (1945) showed that quinine sulphate grains 10 daily failed to prevent overt attacks of M.T. malaria and that grains 5 quinine sulphate daily will not prevent overt attacks of B.T. malaria. With grains 10 daily complete suppression of B.T. malaria was afforded in some cases but not in others. This was with New Guinea strains of malaria and it is possible that other strains were more effectively suppressed. Sinton considers that of the population in areas which in the past have depended on quinine suppression, the majority had had attacks of malaria and as a result had developed a varying degree of immunity to the clinical effects of malaria infection.

Unsystematic suppressive and active treatment with quinine has been considered to be one of the causes predisposing to blackwater fever.

Difficulties in any really extensive scheme of quinine suppression would arise from the costs and the limitation of the amount produced, a state of affairs which has been aggravated as a result of the war in the Far East.

Plasmoquin.—This drug has been described as a true causal prophylactic but only in doses which are toxic. It cannot therefore be used as a suppressive.

Sulphonamides.—Certain of this group suppressed M.T. malaria in a high proportion of cases in a dosage of 1.0 gramme daily but failed to suppress B.T. infections.

Mepacrine (Synonyms : Atebrin ; Atabrine ; Quinacrine).—This drug was discovered by Kikuth in 1930.¹

Mepacrine is an acridine derivative, the dihydrochloride of 2-methoxy-6-chloro-9-diethylamine-pentylamino-acridine.

The work of many observers soon showed that an important advance in the therapeutics of malaria had been made. The value of mepacrine in prophylaxis was then explored in a series of investigations carried out under the auspices of the League of Nations Health Organization.

Field (1937) carried out large scale field trials on coolies at tea and rubber plantations in Malaya. There were three groups. The first had prophylactic mepacrine 0.4 gramme weekly (0.2 gramme on two successive days), the second had 0.4 gramme quinine hydrochloride daily, the third group had an inert yellow tablet. The effects of the prophylactics were summarized as follows :—

"(a) Prophylactic treatment both with mepacrine and quinine effected a marked reduction in the number of malaria attacks which, from the incidence in the control group, would otherwise have been expected ; this reduction for the last six months of the experiment amounted almost to elimination.

¹Kikuth survived the 1939-45 War. He was at the laboratories of I. G. Farben, Elberfeld, in that part of Germany with which the writer was concerned in the early days of the occupation. The writer had many discussions with him. He was still working on synthetic anti-malaria drugs and the exo-erythrocytic cycle of development of the malaria parasite.

(b) The effect of the prophylactic mepacrine on the malarial incidence and on parasite rates was somewhat more potent than that of the prophylactic quinine.

(c) There was a rapid return of the clinical evidences of malaria when the administration of the drug was suspended. . . .”

The quinized coolies suffered from deafness and tinnitus. The mepacrine group developed yellow staining of the conjunctivæ after some months but there were no other toxic effects which were, at that time, clearly attributed to mepacrine. Other authors had, however, described nausea, vomiting, diarrhœa, delirium and psychosis during mepacrine prophylaxis. L. Parrot (1937), carried out similar experiments on the natives of Algeria using quinine and quinacrine (the French synthesis of atabrin with a slightly different structural formula). In the quinine prophylaxis area 0.4 gramme was given daily, in the mepacrine area 0.05 gramme daily. The conclusions reached were that quinine “greatly reduced the splenic and splenometric rates, brought down the parasite and gametocyte rates to zero or thereabouts. . . .” That quinacrine “. . . brought about a very marked fall in the various endemic indices, in particular the splenometric and splenic rates. However, it did not bring the parasite and gametocyte rates regularly down to zero.”

In summing up, the authors consider that the less satisfactory results for quinacrine were due to inadequate doses and recommend that the dose should be doubled when, they consider, the two products would be equally effective. They make no mention of any toxic effects.

Mosna and Canalis (1937) carried out experiments in Sardinia. There were no quinine controls. They gave 0.05 gramme mepacrine daily or 0.2 gramme twice weekly and reported no serious toxic effects and a marked reduction in malaria. They thought that 0.2 gramme twice weekly gave a better result than the daily dose.

Freide (1937), from U.S.S.R. reported “fairly good” prophylaxis from mepacrine, recommended increased dosage (i.e. above 0.05 gramme daily) and that the drug should be given within forty-eight hours each week to provide a high blood concentration for a short period. Occasional toxic symptoms, giddiness, nausea, vomiting and diarrhœa are mentioned.

Studies of the mode of action of mepacrine demonstrated that, like quinine, it is not a true causal prophylactic, i.e. it will not destroy the sporozoites in the body before they begin their asexual cycle of development.

It was thought probable, although not proved, that the parasite, on first entering the body underwent an exo-erythrocytic stage of development during which it was not susceptible to mepacrine or quinine.

In general, the above outline serves to show the information available about mepacrine prophylaxis up to the outbreak of the 1939-1945 War.

EARLY EXPERIENCES IN THE WAR IN THE FAR EAST.

In 1941 numbers of British and Indian troops were dispersed through Malaya. Anti-malarial control was carried out in the vicinity of their camps

by the Malayan Medical Service. Drug prophylaxis was not generally used and the overall malaria rate was about 120 per 1,000 per annum.

In the case of two small detachments in hyperendemic areas mepacrine 0.2 gramme twice weekly was given with excellent results.

Later an Australian Force of some 10,000 men was located in Johore in a highly malarious area. The rate of incidence rose to 12 per 1,000 per week. Quinine prophylaxis grains 6 per day was given, the malaria rate dropped for the first week and then returned to the previous level. The dosage was later increased to grains 10 with little improvement. Subsequently, a travelling team carried out urine tests which showed that only 50 per cent of the force were actually taking quinine.

In late 1941 the forces in North Malaya had a high incidence of malaria. The Malaria Field Laboratory in this area included officers of the Malayan Medical Research Centre. Largely on their advice an agreement was reached to give these troops suppressive mepacrine but insufficient supplies were available. The withdrawal commenced shortly afterwards. Special arrangements were made to collect all mepacrine from rubber, etc., estates before they fell into enemy hands. Plans were made to give all personnel 0.2 gramme twice weekly but Singapore fell before this policy could be put into effect.

THE NORTH AFRICAN CAMPAIGN.

In November 1942, an Allied Force of considerable size landed in North Africa. In the Spring of 1943, steps were taken to meet the forthcoming malaria season. It was decided to give mass mepacrine prophylaxis for the first time to a Force of such a large size. The dosage was 0.2 gramme twice weekly. This began in April 1943. After the administration of the third dose, something approaching a disaster occurred. Thirty per cent of the Force, including in some units up to 50 per cent of personnel, were incapacitated by nausea and diarrhoea. The percentage of personnel with these toxic reactions was very variable between units. It was at first thought that certain brands or batches of mepacrine might be responsible but no clear evidence of this was obtained. Another theory advanced at the time was that the troops were operating in conditions likely to lead to chloride deficiency and that this, in association with the mepacrine, caused the reactions. In the end, no very satisfactory explanation of any sort was achieved. A decision was made to continue the mepacrine, varying the dose to 0.1 gramme four times weekly, or to take 1 tablet (0.05 gramme) or any other variant which appeared suitable to the medical officer of each unit. With perseverance most men overcame their intolerance but a certain number of permanent mepacrine susceptibles was reported.

It was estimated at this time that only 20 to 30 per cent of men were taking mepacrine regularly. Furthermore, malaria discipline as a whole was bad and there was neglect on the one hand of personal precautions such as the use of proper clothing, nets, and repellents, and on the other, of the advice of the medical branch in the selection of sites.

The result was an alarming rise in the incidence of malaria in July 1943 when there were 7,200 cases with between 4,000 and 5,000 constantly in hospital.

This initial mass reaction was of great importance to the history of mepacrine prophylaxis in the Mediterranean theatre of operations. The circumstances became known to many Formation Commanders and Administrative Staff Officers. This resulted in lack of confidence in the drug and weakness of executive and disciplinary action to enforce the taking of it. This lack of interest was evident in the Sicilian landings and it was not until the lessons of the Sicilian Campaign had been driven home by the high incidence of malaria that the active support of Formation Commanders and Administrative Staff was obtained.

THE SICILIAN CAMPAIGN.

In July 1943 began the first assault on Europe when an Allied Force with components sailing from the British Isles, North Africa and the Middle East landed in Sicily during the malarious season.

It was planned that the forces would be mepacrinized for fourteen days before the assault. For security reasons and administrative difficulties this was not achieved in the case of certain troops sailing direct from the British Isles.

The dosage was 0.2 gramme twice weekly. Just after the landing it was altered to 0.1 gramme four days a week. About a month later it was increased to 0.1 gramme six days a week. Although individual cases of intolerance were reported there were no mass reactions to the drug. The advisers would have increased the dosage at an early date but for two facts, firstly, there were some difficulties in the supply of the drug and secondly, because they were concerned lest large scale intolerance should develop.

A factor in the reduction in the number of reactions was that the tablet was now ordered to be taken in the evening and followed by a large drink, usually tea.

There is little doubt that the administration of mepacrine in the early days in Sicily was highly unsatisfactory. Unit and sub-Unit Commanders had not been made to realize the importance of the drug and the taking of it was not enforced in many units. The incidence of malaria rose alarmingly during August. The average incidence during the worst six weeks of active operations (July 23 to September 3) was equivalent to 275 per 1,000 per annum. This seems high, but in Macedonia in 1918 the incidence for the whole year was almost 460 per 1,000 (Thompson, 1946).

Certain formations which fought in the highly malarious plain before Catania had a very high incidence rising in some units to 30 per cent to 40 per cent of strength on a weekly basis.

It was decided to give these troops quinine by a method which was called "blanket therapy." It was the intention to give every man on the same day 20 grains of quinine in the twenty-four hours. Difficulties in the supply of

the necessary amounts of quinine resulted in this "blanket" being given unit by unit over a period of three weeks. This tended to obscure the results of the treatment in these formations.

The results were difficult to assess but it was observed that the incidence of malaria stopped rising at the former rapid rate but did not fall.

A legacy of Sicilian infection was shown by the fact that in the first weeks of the operations on the Italian mainland 15,000 cases of malaria occurred of which over 8,000 were attributed to infection in Sicily.

The Sicilian infections were almost entirely B.T. with less than 1 per cent of M.T.

The malaria plan for Sicily did not, of course, rely entirely on suppressive mepacrine. It may be said, however, that owing to ignorance, apathy, inexperience and the shortage of materials inherent in an assault landing the other methods of control, i.e. protective clothing, nets, protective creams, mosquito control and larvicidal methods, were ineffective.

THE ITALIAN CAMPAIGN.

The lessons of Sicily were studied and applied. Mepacrine was given at a dosage of 0.1 gramme weekly and its administration was backed by intensive propaganda and disciplinary measures. There was a steady fall in the incidence of malaria which by 1945 had fallen to 38.85 per 1,000 per annum.

A graphic illustration is shown by the fact that in the third quarter of 1943 in Italy there were two malaria casualties to each battle casualty, by 1945 there was only one malaria casualty to ten battle casualties.

It would, of course, be wrong to attribute this improvement entirely to mepacrine prophylaxis. There was a great interest in malaria in the whole force, beginning with a committee of all branches at Army Headquarters with corresponding committees at lower formations. A special staff officer—Deputy Assistant Adjutant General for Malaria—was appointed to the H.Q.s of Divisions to deal with malaria and particularly mepacrine discipline.

Malaria Field Laboratories followed close on fighting troops and collected and disseminated information about infected areas. The advent of DDT provided an excellent method for killing adult mosquitoes by residual spraying of accommodation.

Large schemes of larvicidal control were undertaken in base areas by specially organized anti-malaria control units. Extensive use was also made of DDT and paris green sprayed by aircraft.

In August 1944, the Germans in their retreat extensively damaged the bonification works in, among other places, the village of Maccarese, north of Ostia. The civilian inhabitants were given mepacrine prophylaxis at the instigation of military government officials.

Considerable care was taken over the administration of the drug. It was given in doses of 0.3 gramme twice weekly, taken under the supervision of a nurse and the dose recorded in a book carried by the individual. Of 3,850 who had full prophylaxis 2 contracted malaria, of 231 who refused 25 contracted malaria.

THE CAIRNS EXPERIMENTS.

It was felt, particularly in the Far East, that there was need for a comprehensive series of experiments which would demonstrate convincingly the efficacy of mepacrine prophylaxis in such form that it would appeal to Force Commanders and thus form a basis for an intensive campaign of propaganda backed by disciplinary action to enforce the regular taking of mepacrine by troops in malarious areas.

The problem was the more urgent in that malaria casualties in the various South-West Pacific Campaigns were from five to thirty times as numerous as battle casualties.

The work was carried out by a Research Team working under Hamilton Fairley (1945). The experiments were on a very large scale and provide the first comprehensive scientific investigation of chemoprophylaxis.

The conclusions may be summarized as follows : The experiences of quinine prophylaxis have been described. Certain sulphonamides in a dosage of 1.0 gramme daily suppressed M.T. malaria in 20 out of 21 volunteers and cured 17 of them. The same dosage failed to suppress B.T. infections in 21 out of 24, the remaining 3 developing clinical malaria shortly after the administration of the drug had ceased. Mepacrine in a dosage of 0.1 gramme daily suppresses malignant tertian fever and if continued for the requisite period (four weeks) after the last exposure to infection cures the disease. Under similar circumstances mepacrine suppresses benign tertian malaria but overt malaria supervenes with great regularity a few weeks after suppressive mepacrine ceases.

Hamilton Fairley concluded from this that, granted infallible mepacrine discipline, a non-immune force could fight for many months in hyperendemic malaria areas with insignificant malaria casualties. The residual problem would be one of relapsing B.T. malaria.

He claims that application of these principles was one of the main factors in reducing the hospital admission rate in New Guinea from 740 per 1,000 per annum in December 1943 to 26 per 1,000 per annum in December 1944.

In the course of the experiments it was demonstrated that persons having 0.3 or 0.4 gramme of mepacrine weekly, while showing no overt malaria, were yet, in some cases, gametocyte carriers, a very important epidemiological observation which may explain some of the anomalous results observed in the past.

The fact that mepacrine is not a true causal prophylactic was demonstrated by early sub-inoculation tests when 200 c.c. of blood taken from M.T. infected volunteers on 0.6 or 0.7 gramme mepacrine weekly produced attacks of M.T. malaria in the inoculated individuals despite the fact that parasites were never found in thick blood smears. This indicates that mepacrine destroys the young asexual parasites as they enter the circulating blood from the seventh day onwards.

Bang and others (1946) investigated the efficacy of mepacrine suppression in American and Australian troops by a study of the concentration of mepacrine in the blood plasma. They found that the variation of drug level obtained

with a standard dose is so great that, granting that concentration is related to protection, a small percentage would be unprotected by the standard dosage of 0.7 gramme of mepacrine per week.

Reid (1945), working at the Royal Army Medical College, Millbank, showed that the blood mecaprine level is clearly related to the development or prevention of M.T. malaria. He found that in a significant proportion of men taking 0.1 gramme mepacrine daily for three months, the blood mepacrine level may tend to fall even if the administration of the drug is continued regularly.

Further doubts on the "infallibility" of mepacrine suppression suggested in the original Cairns experiments are demonstrated in a recent paper by Hamilton Fairley (1946).

He found that, over a period, the incidence of malaria in troops in New Guinea was low as a result of mepacrine prophylaxis except in one particular area where one formation suffered a severe outbreak of malaria, chiefly M.T. This outbreak was investigated in some detail and it was finally concluded that there existed in this particular area certain strains of *P. falciparum* which were relatively mepacrine resistant.

PALUDRINE.

The ideal chemoprophylactic agent must obviously be a true causal prophylactic. In 1945 Curd, Davey and Rose synthesized two biguanide compounds M.4330 and M.4880 which were causal prophylactics in bird malaria. M.4880 was the more effective and was called paludrine. The value of the drug in malaria therapy was demonstrated by Adams, Townsend and King (1945). The prophylactic properties were investigated by Hamilton Fairley (1946) in experiments analogous with his previous work on mepacrine. He concluded that in M.T. malaria, paludrine acts as a true causal prophylactic, i.e. the malaria was completely suppressed and sub-inoculation tests were negative with doses varying from 100 mg. daily to as little as 25 mg. daily. In B.T. malaria, the drug in similar doses acted as a partial causal prophylactic. No volunteers developed overt malaria or demonstrable parasites whilst having suppression. Sub-inoculations on the 9th and 14th days after exposure were negative. After paludrine administration had ceased all four volunteers of a group who had taken 100 mg. daily developed overt malaria between the 37th and 117th days after the last dose.

Of a group taking 300 mg. daily one developed overt malaria 19 days after the last dose, the remaining 5 had not developed malaria in from 70 to 118 days.

These results were confirmed by experiments of a field type in which volunteers were also subjected to stresses and strains similar to those likely to be encountered on active service.

The schizonticidal action of paludrine was also investigated and it was found that a single dose of as low as 0.1 gramme would resolve but not, of course, cure overt attacks of M.T. and B.T. malaria in non-immune individuals.

This opens up possibilities in the control of outbreaks in large populations by a weekly one dose régime. It is important, however, to remember that these results refer only to New Guinea strains of malaria.

There was an absence of any toxic effects unless administration was increased to 1.0 gramme daily, a dose which is far in excess of that required either for prophylaxis or therapy.

DISCUSSION.

In discussing the value of chemoprophylaxis it is necessary to decide how far extensive prophylaxis can in itself control malaria and to what extent it is still necessary to rely on extensive schemes of malaria control chiefly aimed at larvicidal methods and on the other methods of personal prevention such as the use of proper clothing, mosquito nets and repellent creams.

In so far as military forces are concerned, chemoprophylaxis with mepacrine has clearly proved its worth. It has been demonstrated that with effective chemoprophylaxis, forces can operate in highly endemic areas where other methods of control are impracticable. The crux of the matter is effective administration and this must be achieved by good propaganda and a high standard of mepacrine discipline in the force, without this, chemoprophylaxis cannot succeed.

Paludrine was discovered too late to allow of large scale trials under conditions of actual warfare but it seems clear that it would give even better results than mepacrine with the advantages of reduced dosage, negligible toxicity and absence of yellow staining of the skin.

In mobile warfare in forward areas most of the normal methods of malaria control are impracticable and to a large extent chemoprophylaxis must be the main line of defence. The time has not yet arrived, however, when the well tried other methods of control can be abandoned in line of communication and base areas. Schemes are still necessary for the control of adult mosquitoes, for larvicidal methods and for the other adjuncts of personal protection.

Presumably the complete causal prophylactic will one day be discovered and it may be possible to rely more completely on chemoprophylaxis. Until then, the problem of the B.T. relapse remains to be solved with both mepacrine and paludrine although the advent of paludrine has simplified treatment of these relapses.

Having established the place of chemoprophylaxis in military practice, consideration must be given to its value under civilian conditions. Will it be of any value in dealing with the mass of mortality and morbidity which malaria causes throughout the world?

Sinton (1939) in a study of immunity in malaria and its relation to drug therapy suggested the following general principles.

- (i) When infections are contracted by individuals resident under conditions in which the chances of reinfection except at comparatively long intervals are slight the treatment of choice is one which produces a radical cure of the infection at the earliest possible moment.

- (ii) When individuals are resident under conditions where they are exposed to frequent and constant risk of infection, reinfection and super-infection, the object of treatment should be the rapid production of clinical cure of each attack and not a radical cure of the infection. When practicable this should be combined with clinical prophylaxis so that the number of acute attacks is markedly diminished most especially if the population under consideration does not possess any great degree of natural or acquired immunity.
- (iii) When individuals are exposed only temporarily to chances of frequent infection and super-infection then clinical prophylaxis of the disease with an appropriate drug is the treatment of choice.

Since the above was written, recent experiences have

- (a) discredited quinine as a large scale prophylactic ;
- (b) shown that mepacrine is only effective if given in adequate doses with meticulous attention to the details of administration;
- (c) produced paludrine.

The objection to radical therapy in highly infected populations was that it abolished immunity and that it was only immunity which enabled such populations to avoid disastrous epidemics. Clinical prophylaxis as with quinine or mepacrine does not abolish immunity. It would seem that causal prophylaxis with paludrine may very well abolish it. This would be a subject for future field trials. If it does, it means that paludrine prophylaxis should not be started in a heavily infected population in an endemic area unless it can be continued indefinitely.

Economic factors must also be considered. Mass production of synthetic anti-malarials such as mepacrine and paludrine would in the end make them comparatively cheap. Widespread schemes of malarial control by other methods often have very high capital and maintenance costs.

In the case of malaria in rural Europe such as is seen in Sicily, Southern Italy and Macedonia with a limited and clear cut malarial season it would appear that the ideal approach would involve chemoprophylaxis during the malaria season associated with the usual schemes of mosquito control. Effective prophylaxis would eliminate the gametocyte carrier and this associated with mosquito control should, in time, eliminate malaria.

To consider tropical malaria, it seems clear that for Europeans living in endemic areas and for small mixed communities as in mines, plantations, &c., where physical conditions and expense make large scale control schemes impracticable, chemoprophylaxis will be of the greatest value, especially if associated with local control work. In such communities it should be possible to ensure that the administration of the prophylactic is carried out effectively.

On the other hand, in the case of a town or city in an endemic area with a large European and Native population it is not considered that chemoprophylaxis has any substantial contribution to make. With such a population, the problems of administration and distribution of drugs to ensure regular and adequate doses would be insuperable and in these circumstances nothing can replace the time-honoured methods of mosquito control, improved

as they will be in the future by the use of modern civil engineering machinery and by the use of DDT and other synthetic insecticides.

There remains the most difficult problem, the rural community in highly endemic tropical areas with a population which is heavily infected, impoverished and under nourished. Economic conditions and physical difficulties often make large scale mosquito control schemes impracticable. The institution of prophylaxis would raise problems of practicability of distribution ; of prejudice, apathy and cost.

It is possible that mepacrine and paludrine may have toxic effects on under-nourished populations when given for long periods.

The administration of prophylactic drugs to such populations for indefinite periods can scarcely be visualized. There is no doubt, however, that chemoprophylaxis has a most valuable part to play in the control of epidemics. The experimental evidence suggests that doses of paludrine as low as 100 mg. twice per week would control an epidemic such as that in Ceylon, which was mentioned earlier in this paper. This alone is an enormous advance. For a long term policy, however, chemoprophylaxis will not be the universal panacea for tropical rural malaria.

The real solution lies in a comprehensive campaign directed to education, to improved nutrition, to effective treatment and to localized control schemes using inexpensive locally available materials. Schemes of this sort had had some success in Malaya until they were ruined by invasion.

SUMMARY.

The work on chemoprophylaxis prior to 1939 has been briefly reviewed. An account has been given of experiences in prophylaxis on a large scale in various theatres of operations during the recent war.

An attempt has been made to apply some of the lessons of wartime experience to civilian conditions.

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SUPPRESSION OF MALARIA BY MEPACRINE.

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ALTHOUGH the use of mepacrine in the prophylaxis of malaria was by no means new, the credit for demonstrating conclusively the military value of the drug belongs to the Australian group of workers under Brigadier Hamilton Fairley and his account will be regarded, no doubt, as one of the classic papers of Military Hygiene (Hamilton Fairley, 1945).

Mepacrine was used in the recent war by the Allied Forces wherever troops were exposed to the risk of malaria. Largely as a result of this treatment troops were able to fight in areas where otherwise the casualty rates would have precluded active operations on any scale. It is no exaggeration to say that mepacrine was one of the factors which made possible the defeat of the Japanese. Although the future may witness the evolution of more radical methods of malaria control, mepacrine nevertheless loomed large in the medical history of the war just concluded. It is for this reason that it was considered of value to place on record certain field observations made in Burma on the results obtained by suppression of malaria with mepacrine.

INCIDENCE OF MALARIA.

Most of Burma is highly malarious. Before the Japanese Invasion the mortality among the civil population due to this disease exceeded that from any other cause (Simmonds *et al.*, 1944). In the vicinity of the larger towns such as Rangoon, there is little or no active transmission. The incidence of the disease is also low in the central dry zone about Meiktila. With these exceptions the disease is everywhere endemic and in "foothill" country the intensity of infection is extremely high. The results of a small sample of the many surveys made during the war are set out in Table I and serve to illustrate these features.

TABLE I.

Area	Date	Spleen rate	Parasite rate	Remarks
Rangoon ..	Jan.-Aug. 1946	2.76%	—	Combined result of several surveys
Tann ..	Sept. 1944	73%	6%	Two-thirds of parasite were M.T.
Kalaw Road..	July-Aug. 1945	60-100%	—	—
Silchar ..	Nov. 1944	95%	—	—
Kabaw Valley	—	75%	—	Average of many surveys in 1944
Tennassarinn (Ye Road) ..	Dec. 1945	79%	—	<i>A. minimus</i> larval breeding noted
Near Prome ..	Dec. 1945	72%	—	—
Mawchi Road	Jan. 1946	78%	—	Near Tanngoo
Anisakan ..	Nov. 1945	66%	—	Near Maymyo

Such high endemicity is naturally reflected in the experience of non-immune troops operating in the country. In the first Burma War of 1825-26

the troops who invaded the Arakan suffered relatively enormous casualties from malaria. It is said that in a few weeks everyone who was not dead was sick in hospital. One regiment had a 25 per cent mortality within a month of landing on this coast (Christian, 1945). In the first years of the last campaign, say from 1942 to mid 1944, malaria again took a heavy toll. Several examples can be given. Thus a certain division fighting in the Kabaw Valley in May and June 1943 was suffering a crude rate of 5 per 1,000 per day, equivalent to nearly 200 per cent per annum.

The term "crude rate" in this paper is reserved for the incidence of "malaria and NYD fever" calculated on a return of such cases diagnosed for the most part on clinical grounds. The diagnosis might require revision after investigation of the cases in hospital or C.C.S. and only a proportion of the cases would then be recorded as "confirmed" malaria. The crude rate has therefore obvious drawbacks. However, administrative considerations precluded the compilation of any more accurate statistics within any reasonable space of time and in practice it was found that the crude rate proved of value not only as an index of trends but also in the negative sense that a low crude rate was not compatible with any very high incidence of actual malaria.

On the Arakan coast in June 1944, the crude rate reached 3.24 per 1,000 per day. As late as November 1944 a formation advancing along the Ledo Road recorded a crude rate of 4.3 per 1,000 per day. According to Marriott (1945) malaria was the greatest medical problem in South East Asia Command. During the transmission season up to 80 per cent of all admissions to medical units could be expected to rise from this cause. The crude rate for the Army in this theatre is shown in histogram form in fig. 1.

THE EFFECT OF SUPPRESSIVE MEPACRINE.

Mepacrine for the suppression of malaria came to be used on a larger scale in the latter half of 1944 and supplies were adequate for a general issue to XIV Army by November of that year. Orders governing the issue of the drug provided for the daily exhibition of one tablet (0.1 gramme) per man. The method usually adopted was to issue the tablet at the evening roll call parade. Each unit was required to maintain a register of issues made and to carry its own reserve. The Australian workers were satisfied that "break-throughs" of clinically recognizable sickness could always be ascribed to faulty administration of the drug. By and large this was also the experience with the Burman strains of plasmodium. Where the crude rate for a formation or unit remained high it was invariably found on investigation that compliance with orders left much to be desired. Visits would be paid to the unit in question by anti-malaria officers followed if necessary by representations by the appropriate formation Commander. A vigilant watch on crude rates was always maintained and where necessary attention directed to any slackness in "mepacrine discipline." As the results, in terms of man-power saved, became in due course obvious, Commanders at all levels were, with few exceptions, only too ready to accept advice. A fluoroscopic method of estimating the urinary mepacrine

excretion of groups of men was adopted for use in the field. The results, interpreted statistically, afforded a fair estimate of the regularity and adequacy of the mepacrine intake of the group. Where the method was applied to a unit or formation with an unduly high sick wastage, a salutary effect on the sick rate was soon perceptible.

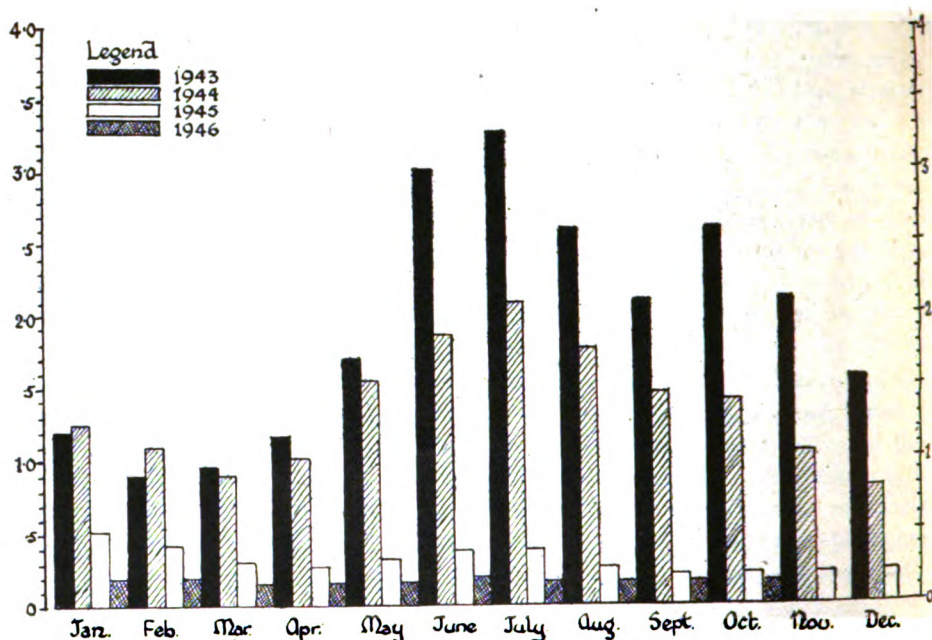


FIG. 1.—Mean mortality crude rates per 1,000 per day of the Army in Burma.

As will be seen from fig. 1, the crude rate for the Army in Burma fell substantially early in 1945 and the rise expected in May and June failed to materialize, although the troops were still exposed to infection in such places as the Arakan, the Kabaw Valley, the fringes of the Pegu-Yoma and the Kalaw and Mawchi Roads. The crude rates for one of the Corps are shown in Table II. During the material times this Corps was fighting on the highly

TABLE II.

		1944	1945
April	.. ..	1.29	0.15
May	.. ..	3.24	0.20
June	.. ..	2.96	0.15
Crude rates per 1,000 per day for a Corps in the Arakan.			

malarious Arakan coast. In 1944 no mepacrine was being used but by 1945 mepacrine had been in use for some time. The experience of Brigade "A"

is shown graphically in fig. 2. When a survey of urinary mepacrine excretion was made in April 1945 there was evidence of grossly irregular and inadequate consumption. Towards the end of May the Brigade fought up the Meiktila-Kalaw axis in very difficult foothill country at a period of active transmission (Point A). A very high crude rate soon resulted. The formation was largely supplied by "air-drop" and the loss of consignments of mepacrine did not help matters. Early in June a "booster" course of mepacrine was given to each man (0.3 gramme daily for five days) (Point B). There was an immediate fall in the crude rate (Point C) followed by a temporary rise and then a drop to a low level which was maintained despite the fact that the brigade continued to be exposed to a high degree of infection.

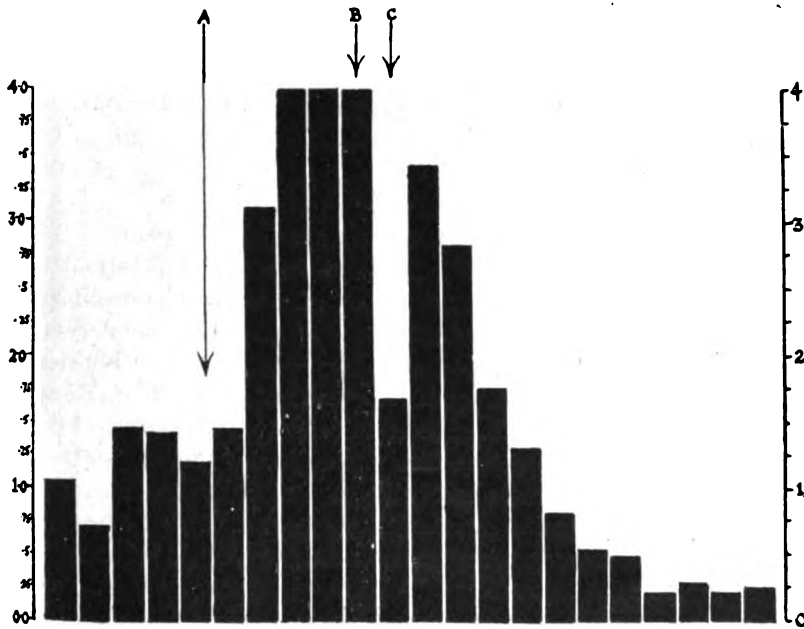


FIG. 2.—Brigade "A." Weekly crude rates per 1,000 per day.

Other instances might be quoted. There was, for example, a certain medical unit stationed in Silchar in November 1944, when the spleen rate in the area was 95 per cent. At that time 40 per cent of the unit personnel were sick with malaria but within two weeks of commencing suppressive treatment the ineffectives had been reduced to just 1 per cent of the unit strength.

It is conceded that the evidence advanced so far in favour of the value of suppressive mepacrine is open to objection as being largely circumstantial. There was undoubtedly a marked reduction in the incidence of "malaria and NYD fever" following on the introduction of suppressive treatment on a large scale. The diagnoses on which the rates were based were rough and ready clinical decisions and as such are not as valuable as would have been the

ultimate diagnosis on discharge from the medical unit treating the case. There is also another consideration which might detract from the value of the evidence. Mepacrine was but one of several weapons used in the battle of malaria. The fact that DDT came to be used increasingly during the very period when the suppressive regime was being enforced extensively in itself complicates the issue. In addition there were the personal measures designed to minimize the risk of mosquito bites; nets, repellent ointments (and later, Skat), regulations as to dress, etc. All these measures were employed with varying degrees of application at different times and in different places. Undoubtedly they all contributed their quota in greater and lesser degree to the shape of the histogram in fig. 1. Such personal measures (with the possible exception of skat) were never really practicable for forward troops, and DDT was rarely used effectively under conditions of active warfare in the jungle forward of, say, Divisional Headquarters. The Brigade fighting up the foothills to Kalaw (fig. 2), for example, was not able to rely on DDT for any protection against mosquitoes. In the case, too, of the Corps "island-hopping" on the Arakan Coast (Table II) any effect on the sick rate due to DDT must be considered negligible.

THE WITHDRAWAL OF SUPPRESSIVE MEPACRINE.

Once active warfare had been completed it was obviously desirable to desist from using suppressive treatment. In an attempt to obtain some guide as to the effect of a general withdrawal of suppressive treatment two specially selected units were ordered to cease taking mepacrine in February 1946. The units selected had been stationed in non-malarious areas (Rangoon and Maymyo) for between three and six months prior to February and during this time had observed strict mepacrine discipline. Before moving to the malaria-free station, however, both units had been exposed to severe risks of infection. Between them the two units mustered 400 men. During the nine weeks following withdrawal, together they produced six proved cases of B.T. relapses all occurring in the fifth to sixth week of the withdrawal period. One of the units was then unfortunately disbanded and further observation of its personnel was impossible. The other unit (180 strong) was observed for a further twenty-two weeks. During this time one B.T. relapse and one M.T. attack occurred as well as three cases of clinical malaria (i.e. which could not be confirmed microscopically). A third unit of 200 men which had not at any time been subjected to any very high malaria risks also ceased suppressive treatment in February 1946, and was under observation for a total of thirty weeks. The only case of malaria which occurred was a B.T. relapse twelve weeks after ceasing to take mepacrine. These observations seemed to indicate that a general withdrawal of suppressive treatment was not likely to be followed by any great increase in malaria casualties, even among troops exposed in the past to severe malaria risks. As active transmission was not occurring in Rangoon a general withdrawal of suppressive treatment was ordered for troops in the city area at the end of May 1946. Numbers of malaria cases admitted thereafter to hospital were available but the "popula-

tion at risk " is only known approximately. The general sick rate in the area was fairly constant at that time and the relative importance of malaria as a cause of hospital admission has therefore been chosen as the best index available of the trend of events. Malaria admissions are shown as a percentage of all admissions in fig. 3. (All cases diagnosed in hospital as malaria have been included. Although a number of these would be clinical cases without microscopical confirmation there is of course a radical difference between such cases and those which generate a "crude rate." The former are diagnosed as malaria *after* all relevant investigations have been completed.) There were

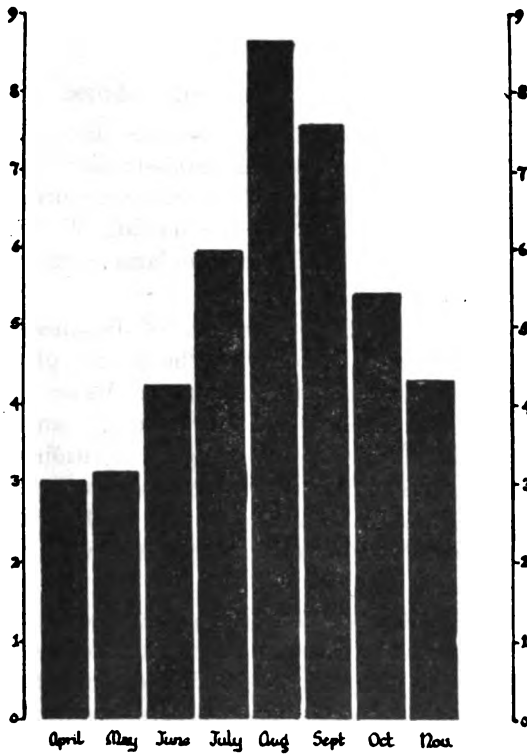


FIG. 3.—Percentages of all hospital admissions recorded as being due to malaria. (Rangoon Troops, 1946.)

approximately 30,000 to 40,000 troops at risk and over five months a total of 798 cases were recorded. This gives a rate per day of between 0.13 and 0.17 per 1,000. It is estimated that approximately 2 per cent of those involved developed malaria in the five months following the withdrawal. The peak incidence occurred about ten weeks after mepacrine treatment was stopped.

Hamilton Fairley had found that 100 per cent of his experimental subjects infected with *Plasmodium vivax* relapsed when mepacrine was withdrawn. The relapses occurred within seven weeks of ceasing to take mepacrine. There are certain important differences between the two series which have to be

borne in mind. In the Australian experiments every man was infected *ab initio* whereas in the Rangoon population there would be a proportion who had never been infected. Again, the dose of infection in the experimental groups was much more massive than that likely to be acquired under natural conditions. Most of the Rangoon troops had taken mepacrine for many months since their last—presumed—exposure to infection, whereas in the experimental groups mepacrine administration continued for a shorter period after the last infection had been contracted. Compared to the Australian experience, the peak in the curve of relapses in Rangoon is somewhat delayed. This may be due to a difference in the strain of organism as James (1945) referred to a similar delay in infections with Mediterranean strains.

MALARIA IN JAPANESE TROOPS.

The Japanese Army did not use mepacrine for suppressive purposes. Quinine was used in this way although administration appears to have been very lax and uneven. Casualties from malaria were undoubtedly extremely high. One, at least, of the reasons for the halting of the Japanese advance at the very gate of India was the severe malaria casualties suffered by the Japanese Armies.

When the surrender came large numbers of Japanese had wandered for weeks in the jungle of the Pegu Yoma at the height of the malaria season. Other bodies of troops had retreated up to the Mawchi and Kalaw Roads exposed to an equally high intensity of infection. As an example of the prevalence of malaria among such troops it may be mentioned that in July 1945 a group of 89 Japanese persons captured in the Southern Shan States were medically examined. 18 were found to be sick with malaria. Of the total, 81 had parasitæmia and of the other 8 all but one gave a history suggestive of chronic malaria.

Towards the end of 1945 large numbers of the Japanese were being congregated in camps in Tennassarín. The amount of sickness due to malaria among these men was enormous. At one camp of 4,500 men the malaria sick rate for December was equivalent to 206 per cent per annum. (These were all cases confirmed microscopically.) At another camp of 2,000 men 16 per cent had enlarged spleens and parasitæmia. At a third camp of 2,000 strong 12 per cent were ineffective early in January 1946 because of this disease.

Early in 1946 some 5,300 Japanese (Camp I) were being employed on an important engineering project in Tennassarín but the sick wastage was so high that work was being seriously curtailed. An average of 30 men were going down daily with malaria. It was decided therefore to give these men suppressive treatment. The results were carefully observed and the diagnosis investigated by microscopy in all cases. The course given was 0.3 gramme (per man) daily for five days and 0.1 gramme (per man) daily thereafter. The results in this instance are not complicated by extraneous factors. No DDT was being used and mosquito nets and repellent ointments were conspicuously absent. Spleen rates in neighbouring villages ranged from 70 to

80 per cent and larval breeding of *A. minimus*—the most important local vector—was observed at the time.

The population at risk remained fairly constant throughout the period concerned so that the trend of events could be fairly represented in terms of actual cases recorded. The data are presented in fig. 4. At Point A mepacrine administration commenced. A breakdown of supply resulted in the dosage being discontinued for two days (Point B). When the work was completed the drug was discontinued (Point C). At a later date the drug was administered again (Point D).

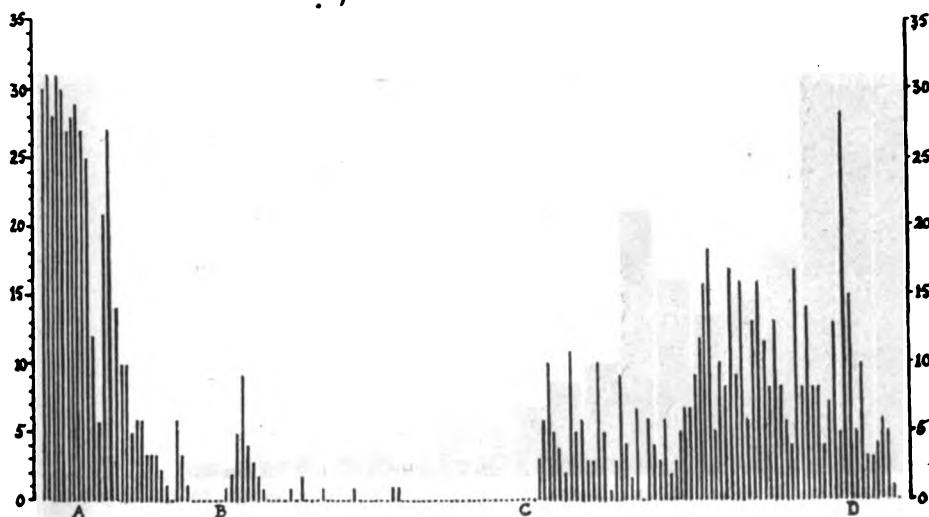


FIG. 4.—Japanese Camp I. Number of Malaria Cases admitted to hospital each day.

Several matters of interest arise from a perusal of these data :

- (a) The " notch " that occurs on the fourth day under the 0·3 gramme daily treatment. In fig. 2 a similar notch may be seen. The explanation is probably that under 0·3 gramme daily overt malaria is being *treated* so that men do not report sick. When on the sixth day the 0·1 gramme course is substituted the rate immediately rises and then falls as true suppression makes itself manifest.
- (b) The immediate effect observed when the course is interrupted (Point B).
- (c) The reappearance of malaria as soon as the course is stopped (Point C). This is not necessarily in conflict with the data presented in fig. 3. In the first place the Japanese prisoners had been on suppressive treatment for a shorter period than the Rangoon troops. In the second place, the Japanese were being exposed to infection while taking mepacrine, whereas the troops in Rangoon had not been exposed to infection for some months before suppressive treatment was stopped. Grouping the daily numbers of cases it is found that the maximum incidence occurs during the fourth and fifth ten-day periods after mepacrine is stopped.

No well-defined peak is to be expected as infection was still being contracted. The gratifying results in control obtained in the case just given were seen again in the case of another group of Japanese. In a camp 2,000 strong, located in the foothills near Toungoo, high malaria casualty rates were recorded in March 1946 (Camp II). Between 5 and 10 per cent of the strength were ineffective at any one time from malaria. Some 6 to 8 cases of blackwater fever were occurring each month. 20 per cent of the personnel had parasitæmia and 16 per cent had enlarged spleens. Towards the end of May 1946, this group was put on suppressive treatment. Fig. 5 shows the results expressed by

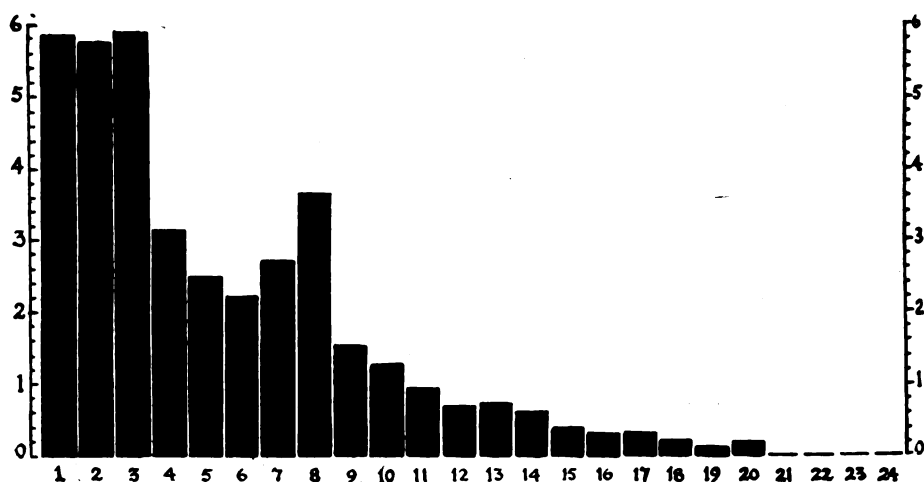


FIG. 5.—Weekly percentages ineffective because of malaria at Japanese Camp II. Suppressive mepacrine started at end of week 2.

way of percentage of strength ineffective because of malaria. Blackwater fever ceased to occur under the suppressive regime. This group, like the previous one, had not the advantage of any concomitant measures such as DDT or personal protection against mosquito bites. The results obtained in both these cases can only be ascribed therefore to the effect of suppressive mepacrine.

SUMMARY.

The effects which followed the use of suppressive mepacrine in malaria among Imperial troops and Japanese Surrendered Personnel are described.

The value of this method in reducing sick wastage from malaria, particularly where other methods of control cannot be applied, is unquestioned.

I wish to acknowledge my debt to Lieut.-Col. D. R. G. Fox, I.M.S., for much information and guidance on the question of malaria in Burma. Much of the material has been culled from official reports written by numerous officers,

but I should particularly like to mention Lieut.-Col. A. P. Ray, I.M.S. To Brigadier A. E. Richmond, *C.B.E.*, Director of Hygiene, the War Office, I am indebted for reading the paper and obtaining official permission to publish it. Mr. G. A. Williams executed the figures.

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PSYCHIATRIC AND ALLIED ASPECTS OF THE PROBLEM OF VENEREAL DISEASE IN THE ARMY.

With particular reference to S.E.A.C.

BY

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It has been common experience of the two World Wars that, whereas the venereal diseases rate amongst the civilian population rises steeply during the war period, the most marked increase in the Army incidence is, in all Armies, in the immediate post-war period.

In South-East Asia Command, in which theatre this present survey was made, the end of the Japanese War had seen a remarkable and steady fall in the incidence of malaria, dysentery, and, indeed, in all admissions to hospital. The only major blot on the preventive medicine picture was the steadily rising incidence of venereal diseases amongst both British and Indian Troops.

In the period just prior to this survey the average admission to hospital rate of troops with V.D. was 140 per thousand per annum for all Allied Land Forces, South-East Asia. In certain Commands within the theatre the incidence rate reached rather more than double the overall figure, whilst one Unit on one return reached the unenviable record of an incidence of 1,621 per thousand per annum.

It was, therefore, decided to make a survey of the psychiatric aspects of this problem, so that a strong and fresh attack could be made upon it through both Medical and "A" channels.

Whilst some of the findings are specific to the particular theatre, it is felt that they have sufficient general application to make their publication of interest.

METHOD OF SURVEY.

The psychiatric survey was planned in three stages—a questionnaire, detailed psychiatric interviews with groups of patients in hospital, and a personal investigation into the views of as many officers as possible.

In the course of planning an Opinion Survey on V.D., No. 1 Special Research Section, R.A.M.C., had already given a questionnaire to a group of British Other Ranks in Transit Camps in Ceylon Army Command. The results of this preliminary questionnaire were later correlated with the initial findings of the Opinion Survey carried out in Transit Camps in Rangoon.

Psychiatric interviews in hospital were carried out on an unselected group of British and Indian Other Ranks in Singapore, Rangoon, Saigon, Bangkok, Batavia and Kuala Lumpur. The majority were in hospital with V.D., but a control group was also chosen of men who, so far as was known, had not had V.D. The interview was to assess the individual's general intelligence and personality; and his medical, psychiatric, social and service history, and to

discover his attitude towards V.D., its social ætiology and its prevention. The results of the interview were entered on a special form.

The assessment of officer opinion was made as wide as possible, both geographically and as regards rank and nature of experience. Information was sought both, formally, in Command and Unit V.D. Conferences, and informally and individually, from officers.

It is not practicable to give the detailed or statistical results of the survey within the scope of this article. A general résumé of the findings, with the conclusions and recommendations drawn, is, however, given, and an assessment made of the relative importance of the various factors.

LENGTH OF TOTAL AND OVERSEAS SERVICE.

Total length of service did not appear to be of special significance.

Amongst the group of V.D. patients interviewed, length of service did not appear as an important factor, but a good deal of other evidence was available to show that there were two main periods of increased risk—the “homesick” phase and the period after three years overseas.

There was a remarkably high incidence amongst troops in Transit Camps awaiting return to U.K.; this was especially marked when factors, such as shipping delays, were present with a resulting fall in morale.

SOCIAL AND SERVICE BACKGROUND.

Since a venereal infection can be regarded as an “anti-social” trend, it was to be expected that a higher proportion of patients with such a disease would show evidence of past social difficulties or maladjustments than in the control group. Taking such factors as delinquency, both Army and Civil, poor work record, inability to settle in the Service or gross resentment towards it, home background and failures to adjust to environment, as pointers, this expectation was confirmed by the survey. Allowance must be made for racial and economic differences, but, whereas 53 per cent of the control group showed a wholly satisfactory background, only 4 per cent of the Indian and 14 per cent of the British troops with V.D. could make the same claim. This point will be discussed again under the heading of personality.

PRESENT SERVICE EMPLOYMENT.

There was a significant predominance of “unskilled” employment amongst the V.D. group; this was especially true of the British Troops. This can be correlated to some degree with the distribution of general intelligence levels in the two groups. Discrepancy between capabilities and type of employment did not appear as an important factor, though some cases were seen where dissatisfaction with a particular type of duty was a causal factor.

It has been generally considered that the V.D. incidence rate is directly and conversely related to the degree of active employment within a Unit. At the time of this survey, re-deployment and liquidation of Units was producing an unavoidably high incidence of relative unemployment; this factor was not, however, reflected in our figures. Nevertheless, from surveys of individual units it does appear certain that prolonged unemployment of troops,

or their employment in apparently pointless tasks, affects the V.D. incidence rate, as it does morale.

PERSONALITY FACTORS.

The classification of personality types for statistics is unsatisfactory since, apart from gross deviations, personality traits in any individual are usually of mixed type. It was, therefore, decided to accept as "normal personalities" those types where no marked deviations were present, and to classify the remainder into sub-groups, largely on the basis of their degree of maturity and environmental adjustment. Table I gives additional detail of this classification and indicates the distribution amongst V.D. patients and Controls interviewed.

TABLE I.

<i>Personality Group</i>	<i>V.D. Patients</i>		<i>Controls</i>
	<i>B.T.</i>	<i>I.T.</i>	
INADEQUATES—constitutional inferiority; maladjusted physical and intellectual inadequates	20%	24%	23%
IMMATURE—maladjusted physical and psychological immatures; separation anxieties	14%	16%	18%
OVER-CONSCIENTIOUS — obsessionals; over-anxieties; marked guilt reactions	3%	8%	6%
PSYCHOPATHS—true constitutional psychopaths of anti-social type	7%	Nil	Nil
AGGRESSIVES*—excitable; quick-tempered	1%	4%	Nil
SOCIAL-MALADJUSTERS*—men with poor unstable work and social records; inability to settle; minor delinquents	15%	24%	12%
SCHIZOID types	8%	Nil	6%
NORMAL PERSONALITIES	32%	24%	35%

*Not amounting to psychopathy.

Previous psychiatric surveys have tended to show a high proportion of inadequate and immature personality types amongst V.D. patients; in the present series the distribution does not show this feature. A general survey of the problem suggests that inadequacy and immaturity are factors of importance when the infection occurs in the homesick phase on first arrival overseas, but that it cannot be regarded as a major factor in the majority of cases.

It will be noted that all the true psychopaths were found in the V.D. group; the proportion of psychopaths (7 per cent) must be regarded as disproportionately high compared to the Army as a whole. The number of men who showed other evidence of past social-maladjustment was significantly higher in the V.D. group.

The proportion of "normals" is rather higher in the control group; this difference is almost certainly too low since the control group were men in hospital and probably included a higher proportion of abnormal personality types than would a cross-section of fit troops.

No officer patients were included in our series of interviews, but such officers with V.D. as were seen at other times were almost invariably either socially maladjusted or inadequate personalities with poor Service records.

It is of interest that ward disciplinary problems were reported to be more common amongst V.D. cases than with other patients. In at least two Centres

these problems were very severe and did not respond well to any form of handling. In general the characteristic attitude of the patient with V.D. towards his disease and position was one of bravado or apathy.

Almost all the cases of repeated infection occurred amongst the psychopaths, aggressives or socially maladjusted groups.

SOURCE OF INFECTION.

All three phases of the survey showed evidence of importance in connexion with the sources of infection, though it is probable that these points are specific to the particular theatre.

With Indian Troops the prostitute formed the main source of infection, though brothels, as such, were relatively little used. It was the general experience that the enforcement of Out-of-Bounds areas was of little value, and that a high proportion of infections occurred during the hours of daylight, especially the afternoon.

The prostitute was the source of infection in half the cases of British Troops, taking the theatre as a whole, but in some areas the principal danger lay with the "girl-friend." Here the story was of an attractive local girl, met at a dance-hall or cinema, with whom the soldier would "walk-out" for several weeks before intercourse took place. By this time the soldier was convinced that the girl was safe and, as a result, took no precautions. It was hard to convince these men that a very high proportion of the willing native female population was infected. It must be considered also that intercourse with a "girl-friend" under these conditions is a stage higher in the level of normal social adjustment than is intercourse with a prostitute. Many men who for ethical, æsthetic or other reasons would not approach a prostitute will willingly expose themselves to risk with a "girl-friend." This factor is, therefore, of considerable importance in planning any campaign to reduce the V.D. rate, though it was a factor that had never been stressed previously in our propaganda.

Our results showed that the risk of infection for each time of intercourse was extremely high in this theatre; this again was a point requiring special stress in any propaganda campaign. There was no doubt, at this particular period, the ease with which promiscuous intercourse could be carried out; and the encouragement given by the willing female native population was, in many areas, abnormally high. The degree of infectivity amongst this population had reached abnormally high figures, thanks largely to the period of Japanese rule. In the two areas from which figures were available, 90 per cent of the willing female population were known to be infective.

Another important factor in determining the source of infection amongst British Troops was the absence, at least in the early post-war months, of any British women, with whom the O.R. could have normal social contacts. This point will be raised again later.

It is beyond the scope of this article to discuss the psychopathological aspects of prostitutism, though this is clearly an important factor. Preliminary work on the rehabilitation of infected women undergoing compulsory treatment was commenced in Batavia, but an extensive follow-up would be necessary to confirm the results obtained.

Similarly, the value of compulsory treatment of infected women as a preventive measure was not surveyed. It was regarded by Administrative Officers as a necessary measure in those areas where it was in force. It was noted in Batavia that its introduction led to a marked, but not sustained, fall in V.D. incidence amongst troops. It has the same psychological dangers as the controlled brothel, namely, the often mistaken conviction that intercourse can be carried on without risk, and therefore without precautions.

There was little doubt that the introduction of penicillin therapy, and the wide publicity that had been given to this "wonder drug," was a factor in encouraging exposure to risk. The high relapse rate on penicillin treatment alone had not then been publicized and it was commonplace to hear the view that an attack of V.D. "no longer mattered or meant more than a few days in hospital."

REASONS FOR INTERCOURSE.

It is clearly of importance in planning a campaign to reduce the V.D. incidence rate that we should know the main motives which lead to exposure to risk of infection. It is, of course, true that the detailed motivation will vary in each case, and to some degree with the same man on different occasions. It proved possible, however, to group the motives under a number of general headings. The objection was raised that men would be unwilling, or unable, to give the exact motives for their exposure to risk. This objection would probably have been valid had the survey been based on simple question and answer alone. A full psychiatric interview served to determine the man's whole general attitude towards the problem and, in this instance as in others, what remained unsaid was sometimes of more significance than any direct reply.

Very few men attributed their exposure risk to any one single motive, and there appears little doubt that there are commonly a number of associated motives acting together. There was in addition a correlation between motivation and personality types; for example, almost all those men who gave as their reasons "led on by other men," "I wanted to prove my manhood" or "domestic trouble with an unfaithful wife" were of the inadequate or immature groups.

The largest factors were the two closely associated, "it's the obvious thing to do" and "I just wanted to." The frequency of these factors was of course largely self-evident, but this does not mean that they have always been given the important place they warrant in our anti-V.D. propaganda.

Amongst British Troops, alcohol was quoted as a very frequent factor; this rarely amounted to drunkenness, but it was very evident that moderate quantities of alcohol produced three important results—an increase of desire, a weakening of normal ethical or æsthetic restrictions and a failure to take adequate precautions during or after intercourse. Almost all those men who gave alcohol as a major factor admitted also that they had failed, for this reason, to take any, or adequate, precautions.

"Led on by others" was frequently given as a cause, though it is to be noted that it was rarely quoted as the only factor; its most common association was with the taking of alcohol.

Homesickness, with or without domestic worry, was given only as the sixth most important reason. Nevertheless there were definite cases where news of a wife's unfaithfulness, or other home worries, were the direct precipitants of an exposure to risk of infection. It became very clear that there was often a failure to give adequate and immediate welfare help and advice in these cases at unit level; it was felt that, in some at least of these cases, really good welfare help given by the sub-unit commander would have avoided the risk of infection.

Only a small number of men stated the view that it was unhealthy to go for long periods without intercourse, but the questionnaire revealed that this was, in fact, a quite commonly held view. It was in some cases related to the fear of impotence which enemy propaganda had laid at the door of suppressive mepacrine therapy, a fear that was very real to most Indian, and to a small number of British Troops.

The commonest factor suggested by the control group was "being browned off," though this reason took fourth place only amongst the V.D. patients. This question will be more fully discussed later.

PROPHYLACTIC METHODS.

One of the most striking, but not altogether unexpected, findings of the survey was the relative infrequency with which prophylactic measures were used by men contracting V.D. The value of prophylactic measures properly used is without doubt; in one large Medical Unit which I visited, an average of 15 men per day were known to have used the Unit P.A.C., but in three months only one case of V.D. occurred in this unit; that is one infection per 1,350 known exposures to risk.

What was more alarming was the sometimes total ignorance of prophylactic measures shown by many men, and the great reluctance to use these methods especially amongst Indian Troops. Even experienced Indian Army Officers have admitted that the education of their men in the use of these methods is almost impossible, and it was clearly shown that results could be hoped for in most cases, only when instruction had been given to very small groups of men by their own V.C.Os. or N.C.Os. whom they knew well.

There were other factors which contributed to this failure to use precautionary measures. Many of the condoms which had been distributed during the last months of the war period had proved grossly defective, with the result that much faith in their efficiency had been lost, even after all defective batches had been withdrawn.

In most areas accommodation was at a premium, and great difficulty was found in providing suitable premises for P.A.Cs. in the large centres. Very few of these P.A.Cs. had running water, adequate sanitary facilities or good lighting; what was more important is that they were frequently unsupervised and ill-kept. It has been argued that a man who is willing to use a native

brothel will have no scruples over a dirty, dark P.A.C., but it is clear that the whole question of motivation is so different that this view is entirely mistaken.

For these reasons great stress was laid in this theatre on the provision of good unit P.A. Rooms, where post-exposure ablution could be carried out as well as E.T. packets obtained. Here, too, special difficulties appeared. Too often supervision fell down between the joint responsibilities of O.C. and M.O., and a good unit P.A. Room was often the best indication of a low unit V.D. rate and of a keen and realistic approach to the problem. Staffing of unit P.A. Rooms raises difficulties, for it was clearly shown that men are less likely to use these facilities, and admit to the risk-exposure, when they know they will be seen by others of their own unit. This was especially true in those units who kept records of the men using the P.A. Room. A combination of publicity for the whereabouts, function and value of the P.A. Room, with anonymity in its use, is essential for good results. This factor applies with equal force to the arrangements for the distribution of E.T. packets. In one unit, where the O.C. interviewed every man asking for an E.T. packet, it was not surprising that there was little demand for these facilities—and a high V.D. rate.

In some areas disciplinary action was taken against men who had contracted V.D. and could not prove that they had taken precautions. This was considered of value in the areas where it was in force, but it is clear that it has many loopholes and, in addition, the necessity for proof destroys the essential anonymity of the P.A.C. Punishment is of doubtful psychological value in these cases, unless it has the stamp of inevitability, consistency and justice; in the special circumstances these are difficult to achieve.

Encouragement, when deserved, is often of greater psychological value than is continual criticism, and good results were obtained in those areas where the publication was made in Command Orders of the names of those units whose V.D. figures were low or were consistently falling.

PROPAGANDA.

In theory propaganda, varying from unit lectures to active advertising methods, plays a big part in the Army's anti-V.D. campaign. It was, therefore, all the more alarming to learn that in practice the quantity and quality of our propaganda fell far short of requirements.

Both our interviews and the questionnaire showed that it was the exception rather than the rule for regular effective talks to be given in units. Too often there was a lengthy stereotyped lecture on the purely medical and anatomical aspects of the problem; rarely were talks given to small groups of men, with an opportunity for discussion and questions afterwards. In some units it was clear that no attempts at all were being made to give the men information even about local P.A.C. facilities, or prophylactic measures. This was reflected in the observation that many unit P.A. rooms had ablution instructions in small print only and often in a dark, inaccessible corner of the room.

The medical officer has a very important part to play in unit V.D. education, but on psychological grounds talks on the general aspects of V.D.

are accepted more willingly and convincingly from a well-briefed and good junior combatant officer, who is intimately known to his men. Talks must be brief, striking and to the point, and it goes without saying that the speaker must have a sound viewpoint himself on the morale and sociological implications of the problem. Set, routine, lectures will produce only boredom, resentment or frank disbelief.

The British and Indian V.D. films available were of a high standard and, when shown, were reported as being well received. It was, however, surprising to find what a very high proportion of troops had never had the opportunity of seeing these films, either overseas or in a home command.

In the early post-war months, posters designed to reduce the V.D. incidence were entirely unavailable, except in Singapore itself. Later a number of excellent posters did appear, largely as the product of local talent. It was found that command competitions for the best poster produced not only some excellent designs, but stimulated at the same time unit interest in the problem. This method had the additional advantage that it made a frequent change of posters possible; as in all forms of scientific advertising, a constant re-awakening of interest is essential. The tattered poster still left on the notice-board after many weeks cannot hope to give results.

There was at first considerable resistance to the exhibition of these posters in unit recreation rooms, canteens, etc., but it is clear that to restrict them to a dark corner of the latrine is to defeat their purpose and give a distorted viewpoint on the whole problem. We were fortunate that Command Education Officer agreed to take over this side of our propaganda as a responsibility of his department, and he was latterly able to organize a series of striking photographic displays with Ministry of Health and R.A.F. propaganda material.

Since each form of propaganda has its own particular audience, it is essential that we utilize all the methods at our disposal in order to reach the largest possible number. There is ample scope here for a strong propaganda drive based on known scientific methods.

EMPLOYMENT OF LEISURE TIME.

For reasons outside the scope of this article, South-East Asia Command faced at all times a chronic shortage of troops amenities, entertainment facilities, canteens and clubs. This was especially true of the immediate post-war months, and it was reflected both in Command and Unit facilities.

A great deal was done in some areas to utilize local resources and to carry out the old-established Fourteenth Army slogan of "improvisation." Shortage of accommodation, of cinema projectors, of games material and above all of willing voluntary workers from home were only being met after this survey was completed, and there was little doubt that these shortages were determining factors in the high V.D. rate both by direct effect and by their effect on morale.

It is an obvious fact that exposure to V.D. risk must normally take place during the men's off-duty time, and anything that can be done to occupy this period in alternative pleasant ways must inevitably reduce the V.D. incidence rate. Such a method alone will never abolish V.D., but it can do more

than any other factor to reduce its incidence in an overseas command. If we can offer no adequate alternatives, the men off duty must be thrown on to local native resources, and these carry with them in a theatre such as the Far East a high temptation risk for promiscuous intercourse.

A survey of unit recreational facilities was especially striking. Too often unit commanders and medical officers, for this is a joint responsibility, were content with a single bare recreation room for their men, devoid of any attempt at comfort, devoid of reading or games material and certainly not tempting as a place in which to spend one's leisure hours. Other units which successfully utilized the limited resources available were amply rewarded by improved morale and a lowered V.D. rate. I saw two units in adjacent, and identical, accommodation; one had organized excellent games and recreational facilities whilst the other had done little or nothing in this direction. At the time of my visit the V.D. rate of the first unit was 12 times lower than that of the other.

As regards non-unit facilities there is little doubt that the non-military club, run by voluntary workers, has many advantages. Here the inevitable monasticism and routine of Army life can be modified and normal social contacts with the opposite sex are possible. The soldier of a citizen conscript army must be able to feel part of the community of his overseas club, as he would towards his own favourite pub or cinema at home.

MORALE.

The results of this survey amply upheld the view that the prevention of V.D. in the Army is a morale, rather than a purely medical, problem and that factors which lower morale will inevitably increase the V.D. rate in the force.

A post-war period must always lead to grave morale problems, and there was no exception in this theatre at this time. The inevitable unemployment of troops used to active purposeful duty, the natural desire to return to civilian life now the war is over, the loss of the powerful war-for-victory incentive, the loss of many experienced officers and N.C.O.s on release, the gradual withdrawal of free amenities and entertainments all produce an adverse effect on morale. All these factors are closely interwoven and cumulative; the very loss of experienced officers will in turn lead to errors of man-management, to impaired welfare facilities of troops and to added strain in the individual promoted beyond his experience and capabilities—each potent sources of lowered morale.

It is no coincidence that a unit with a low sick rate, an empty guard-room and few cases of V.D. has also a high morale; the precipitating factors are the same in each case.

Morale has been defined as the driving force of a group of people working together for a common purpose under common leadership. Where leadership and man-management are good, with all that entails in welfare, amenities, discipline, understanding and mutual respect, each man will form part of the group; he will be proud to be a member of that group and the common purpose of the group will become pride of unit and service. Without good leadership and example at all levels good morale is impossible. Without a satisfactory

approach to this whole question of morale and man-management, we are doing no more than applying superficial palliatives to the problem of V.D. prevention.

CONCLUSIONS.

It seems clear that we have to deal with three large sub-divisions of the Army population :—

- (i) The “no-risk” group—men who are unlikely to expose themselves to the risk of V.D. infection under any circumstances, whether for moral, æsthetic or other reasons.
- (ii) The “incorrigible” group, who are likely to risk and get V.D. despite all efforts at prevention ; this group will include most of the socially maladjusted and the psychopaths who are already of doubtful value to the Army.
- (iii) The “preventable” group who may respond to one or other of our methods of reducing the V.D. rate.

Group (iii) represent the greater proportion of the total population of a conscript Army overseas, and is that part against whom all our efforts should be directed.

The approach to the problem of reducing the V.D. rate must be sixfold :—

- (i) Measures directed to maintaining high unit and Army morale.
- (ii) Measures to ensure the best possible use of leisure time by the provision of adequate and suitable recreational amenities.
- (iii) Propaganda measures to stimulate a sound sociological opinion on the problem.
- (iv) The popularization of adequate preventive and prophylactic measures for those who still expose themselves to risk.
- (v) Direct medical action against the source of infection.
- (vi) The elimination of grossly unstable individuals from the Army group, to which they are in all ways more of a liability than an asset.

The problem requires the constant and enthusiastic attention of Administrative and Medical Authorities, Venereologists, Psychiatrists and Regimental Officers ; the approach must never become stereotyped but must be constantly kept up to date with the situation.

I am indebted to Major-General Maclean and Major-General Tyndal, D.A.G. and D.M.S., respectively, A.L.F.S.E.A., whose support and enthusiastic reception of the findings made this survey possible. I would also express my thanks to the Area Psychiatrists who helped to carry out the survey, to No. 1 Special Research Section, R.A.M.C., and to my predecessor as Adviser in Psychiatry, Lieutenant-Colonel R. F. Tredgold, R.A.M.C., who originally suggested the outline of the survey.

Clinical and Other Notes.

**THE PITRESSIN HYDRATION TEST IN THE
DIAGNOSIS OF EPILEPSY.**

BY

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In perusing case records of patients diagnosed *Hysteria (motor-convulsions)*, one often sees that both physician and psychiatrist were in doubt as to whether the condition were epilepsy or hysteria. After observation in hospital unless the patient has definite epileptic fits he may be regarded as hysterical and disposed of accordingly. Should the patient then turn out to be a true epileptic, it is important to realize that not only injury (organic trauma) but also psychological trauma may result. The patient may have received superficial psychotherapy with the reassurance that once his mental conflict is solved the fits will not recur. The psychosomatic disturbance of epilepsy may be palliated and the patient actually improve until, one day, he has another fit. His confidence vanishes together with whatever plans he made for himself and he slumps into depression. Now, neither physician nor psychiatrist will find him an easy patient to treat, for he is distrustful and, possibly, even negativistic.

In the absence of facilities for electro-encephalography, the Pitressin Hydration Test may be found useful.

The following is an illustrative case :—

CASE-RECORD.

Sjt. G. Y., a regular soldier, aged 19½, was admitted for evacuation to the U.K., having been diagnosed motor hysteria.

On admission he had no complaints but wanted something done about his fits because he was afraid they might ruin his life.

Present Complaint.—Fits started at age of 18½, one night when he was in bed; he remembers only waking up in hospital the following afternoon though the actual fit lasted ten minutes. Two of his N.C.O. friends witnessed this fit. Here it must be noted that he was stationed in a very hot part of India at the time, but he was happy in his work and undisturbed by heat. After a period of six days' observation, during which he had no fits, he was discharged. Twenty days later, while handing over his duty one night, he had another fit, again in the presence of his two friends. This time he was in hospital for twenty-eight days during which he had several fits. A medical officer described one fit as follows : "foaming, screaming and struggling, no injury, no incontinence. Had premonition of fit by dizziness. Fit was mainly muscular spasm and there was a period of excitement following it. After seizure there was complete amnesia, weakness and left frontal headache." The psychiatrist noted : "has been in hospital on three occasions on account of fits; these fits have been observed in hospital and are strongly suggestive of hysteria." These attacks lasted about ten minutes, they were always in

the presence of other persons and the patient had never seriously harmed himself nor exhibited incontinence. The number of fits till admission to this hospital was about twenty-four. He has not had an attack for ten days while under observation in this hospital.

Family History.—Brother discharged from R.A.F. with "confirmed epilepsy." He has never seen him in a fit. One sister is very nervous and two other siblings are alive and well. Mother has "hysterical fits"; he has only seen one when aged 12 and "never wants to see one again." Father was a cruel man and left the home when patient was aged fifteen (? psychopath). The children were separated and brought up in a Poor Law Institution.

Personal History.—*Childhood:* Poor surroundings, never had a decent home, never happy as a child; was under strict discipline at school where he developed "nervousness." Remembers a few neurotic traits: as child "could not stop laughing and had to be locked up in a room."

Civilian Life: Worked steadily for four years as a clerk and then volunteered for the Army.

Service Life: Did not need to make an effort to adjust himself as he was already "used to discipline from school." Quite happy; quickly promoted in India. A regular soldier he was content to make soldiering his career. Until the fits started he was efficient but since then his efficiency deteriorated and he has been forty days off duty.

Emotional Growth.—No sexual interest. Very attached to mother "being the only child who stuck to her."

Past History of Illnesses.—No head injury, nil relevant.

PHYSICAL EXAMINATION.—N.A.D. except for signs of sympathetic system disturbance due to anxiety, i.e. mild tremors, sweating, tachycardia of 90 when excited, hot flushes. Skull and muscles X-ray, no cysts, no sign of past injury.

MENTAL EXAMINATION.—*Behaviour:* fidgety, normal otherwise. *Affect:* emotionally unstable and immature (burst into tears during simple interview). *Personality:* sensitive, shy, not integrated. He would be deeply concerned at the least adverse comment from a superior. *Intellect:* good functions. *Intelligence:* S.G. II (Matrix score 49 in 40 mins.). *Insight:* present. He was said to show indifference to his fits but fear of epilepsy and was found to be developing a true anxiety state.

It was decided to give him the Pitressin Hydration Test to elucidate the diagnosis.

The patient was confined to bed and put on a normal diet. His urine was tested for albumin and sugar and found to be normal. Hypertension, myocardial insufficiency, diabetes, and kidney disease were excluded on re-examination. Thus, in the absence of contra-indications, the test was carried out as follows:

An initial dose of 0.50 c.c. of a Pitressin preparation was given intramuscularly, with 300 c.c. of water orally and subsequently two-hourly I.M. injections of 0.25 c.c. each, followed by 300 c.c. of water. A total of 10 injections was given. An intake and output chart showed the antidiuretic effect with retention of water. The body-weight was increased by 2 per cent.

After the fifth injection (total 1.50 c.c. pitressin and 1,500 c.c. extra water, 2,800 c.c. total fluid intake and 600 c.c. output) the patient had an epileptiform convulsion. He became dizzy (aura), confused and incoherent and then lost consciousness. He exhibited jactitations and later tonic and clonic convulsions of the hands and oculogyric convulsions; his pupils were dilated, pulse 82, respiration 28. He had a similar attack during the early hours of the morning after the tenth injection, twenty-four hours after the beginning of the test (total 2.75 c.c. pitressin, 3,000 c.c. extra water, 6,000 c.c. total intake and 3,900 output fluid). Unfortunately, no medical officer being present during these attacks, neurological examination was not carried out. The reports of the day and night charge orderlies (experienced M.N.O.s) tallied. They thought the seizures were not imitable and that they were genuine epileptic attacks. Later he was observed by an officer in a spontaneous seizure, which confirmed the epileptic nature of the convulsions.

Patient was told of his condition and how it could be controlled. Superficial

psychotherapy was re-orientated and applied together with a short period of sedation. The patient became more cheerful and confident because "he knew where he stood now" and was prepared to cope with his handicap. He also realized that his mental condition might well precipitate the attacks. The Anxiety State lifted.

DISCUSSION.

The case described fulfilled most of the clinical criteria of hysterical fits :—

- (1) A poor psychiatric background.
- (2) A psychopathic personality.
- (3) Witnessing fits before.
- (4) Fits occurring always in the presence of other persons.
- (5) No severe injury incurred.
- (6) No incontinence.
- (7) Convulsions atypical and can usually be imitated.
- (8) The fits starting fairly late in adolescence.

(Described in that order to emphasize the positive psychiatric criteria first.) There were enough points to render the diagnosis doubtful: the presence of an aura, a positive family history and the absence of a typically extroverted hysterical type, he was intelligent and willing to use insight. The Pitressin Hydration Test, a slight modification of that described by Blyth (1943), was positive. This discredited the previous diagnosis and suggested a primary diagnosis of idiopathic epilepsy (latent). In this connexion it is worth while remembering that there is a psychic form of epilepsy when convulsions are not usually present and the psychiatric symptoms (from irritability to attacks of mania, etc.) predominate. Moreover, if an epileptic happens to be hysteroid, he may quite easily make use of his symptoms. Thus the differential diagnosis between the two conditions can be very difficult. It must be stressed that a psychiatric diagnosis should be made only on psychiatric grounds and not, as often, by exclusion of organic disease. Furthermore, in L. Alexander's words (1944): "The diagnosis of hysteria should only be accepted upon completion of the cure of the presenting conversion symptoms. . . . Hysteria is a working hypothesis valid only for a limited time (e.g. prior to treatment)." The Pitressin Hydration Test is of little value when the result is negative. When it is positive, and a convulsion is observed (in a patient hitherto not having been seen in a fit), the diagnosis becomes almost certain. As a word of warning it should be added that the test is not devoid of danger (e.g. status epilepticus and post-convulsive palsy) and adequate precautions are therefore necessary.

SUMMARY.

A case with a doubtful diagnosis of hysteria (motor) has been described. The Pitressin Hydration Test proved the diagnosis to be idiopathic epilepsy; accordingly, the patient was treated successfully.

The Pitressin Hydration Test has been described and the differential diagnosis between hysteria and epilepsy discussed.

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SULPHONAMIDE ANURIA.

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THE dangers of crystallization of sulphonamide drugs within the urinary track are well known. That the danger of anuria is materially increased in a patient with kidneys already damaged by disease is demonstrated here; and an opinion as to the site of the obstruction within the urinary track is discussed.

Recently four cases of sulphanerazine anuria, one of sulphanilamide anuria and one of sulphathiazole anuria have been treated in this hospital. All except one of these were healthy soldiers who had been injudiciously, or illegally, treated for venereal disease; all but this one responded to medical treatment alone. One was a patient while under treatment for *B. coli pyelitis* of a hydronephrotic kidney.

The routine treatment adopted is as follows:—

On admission: the patient is kept strictly in bed and placed on an intake and output fluid chart. One pint of 3 per cent sodium citrate solution is given by fast drip intravenously followed by intravenous normal saline or glucose saline by drip. The blood urea is estimated and all specimens passed *per urethram* are sent for full laboratory examination. In addition four-hourly mist sodii cit. grains 20 to the ounce is given by mouth, and the diet is fluids only. A careful watch is maintained for any signs of alkalosis manifested by vomiting or tetany.

If no urine is passed after several hours, sodii sulph. 4½ per cent one pint is given, followed by further salines. In all but two of this series, urination was established again after twenty-four hours and normal output progressively returned.

In the first case the patient, an Australian, had been taking sulphathiazole for an unspecified time, without supervision, for urethritis.

14.9.46: He was admitted complaining of acute pain in the right loin and flank, colicky in nature and passing dark bloody urine a few ounces at a time only. The urine was found full of R.B.C.s and sulphathiazole crystals and the blood urea was 78.1 mg.

per cent. Accordingly treatment was commenced with sodii citrate 3 per cent 1 pint followed by i.v. salines 6 pints per day and fluids by mouth.

16.9.46 : He showed no signs of uræmia, although passing no urine at all. Hypertonic sodii sulph. 1 pint was given among the alkalines.

17.9.46 : 6 oz. dark bloody alkaline urine with no crystals was passed.

18.9.46 : Sodii sulph i.v. one pint again given and he passed further 10 oz. bloody alkaline urine.

19.9.46 : Passed 78 oz. of urine.

20.9.46 : Blood urea was 31.2 per cent urine still contained R.B.C.s and albumen++.

30.9.46 : Urine was clear and patient was allowed up.

2.10.46 : Discharged from hospital fit and well.

It will be noted that this man went for two and a half days without passing any urine with no signs of impending uræmia, and urination was finally fully established by medical treatment alone—nearly five days after the first signs of anuria.

Contrasted with the above is the following case complicated by hydronephrosis which presented unusual symptoms and progressed from bad to worse under medical treatment.

A CASE OF SULPHAMERAZINE ANURIA COMPLICATING HYDRONEPHROSIS.

A Gurkha N.C.O., aged 22, had an attack of fever in August, 1946, lasting for about a week, and developed pain on moving his right hip-joint. Pain and limitation of movement gradually increased and he was admitted on October 10, 1946, as a case of arthritis of the right hip.

On admission the patient was afebrile, anæmic, with flexion and external rotation deformity of the right hip-joint, wasting of right thigh by 1½ in. There was marked tenderness on the medial aspect of ascending pubic ramus and rectal examination showed marked tenderness on the right side and a tender enlarged right seminal vesicle with a nodule.

X-ray : Hip Joint N.A.D. Slight rarefaction ascending pubic ramus.

The patient developed a swinging temperature a few days after admission. W.B.C. count was 11,800. Urine acid : Deposit a few W.B.C.s and pus cells. It was provisionally diagnosed as a case of seminal vesiculitis with adjacent pelvic cellulitis causing psoas spasm. Accordingly the patient was put on a course of penicillin 40,000 units three-hourly, and urinary investigation was started. Temperature settled down to normal. Psoas spasm passed off, and rectal tenderness subsided.

Six specimens of twenty-four hours urine : negative for acid fast bacilli ; two specimens of midstream urine on culture showed a heavy growth of *B. coli* organisms. Intravenous pyelogram revealed two opacities in the left renal shadow and marked hydronephrosis of the left kidney, intrarenal in type.

On November 7, 1946, the patient was put on a course of sulphamerazine 8 tablets stat., and 4 tablets six-hourly with mist. alk. diuretica six-hourly, and 8 pints of water a day.

On November 9, 1946, the patient developed severe lumbar pain, vomiting and hæmaturia after having had 22 grammes of sulphamerazine. No urine was passed after passing 1 oz. of dark blood stained urine at 1330 hours, full of crystals.

Sulphamerazine was stopped, patient put on two-hourly mist. alkaline, plenty of fluids by mouth. One pint of 3 per cent sod. citrate followed by 2 pints of glucose saline by i.v. drip had no effect. A further 1 pint sod. citrate was given and i.v. salines continued.

Late on November 10, 1946, the patient developed uræmic symptoms ; was drowsy, vomiting frequently, hiccough and slight puffiness face. B.P. 160/90. One pint of 4.7 per cent sod. sulphate followed by isotonic saline by i.v. slow drip did not relieve the anuria.

On November 11, the patient developed tetanic convulsions due to alkalosis. Carpopedal spasm and facial nerve irritability were present, also generalized œdema ;

B.P. 130/70. Blood urea 136 mg. per cent. Vomited several times. Passed 2½ oz. dark urine. I.V. drip was discontinued and patient taken to theatre.

On cystoscopy there was marked bullous œdema of the bladder especially around the ureteric orifices. The right ureteric orifice was blocked with crystals, and there were sheafs of crystals on the bladder wall and the left ureteric orifice could not be found in the bullous œdema obscuring it. Ureteric catheters could not be passed.

On November 12, the general condition of the patient was poor and deteriorating. Operation was therefore decided upon under unilateral spinal anæsthesia by Major Allan Brown. The good right kidney was exposed by an oblique incision and the kidney was found tense and enlarged. Through a small incision on the convex margin of the kidney the renal pelvis was entered and 10 oz. of urine drained into the wound. A malecot catheter was tied into the renal pelvis. During the first twenty-four hours after nephrostomy 12 pints of urine drained from the tube. Fourteen hours after operation patient started passing clear urine *per urethram* and passed 4 pints in twenty-four hours.

The general condition showed a remarkable improvement and the patient made a complete recovery. The nephrostomy tube was removed on the fourth day.

November 18: Blood urea: 55 mg. per cent. Urine culture: Sterile.

November 29: I.V.P. repeated. Condition same. No urinary or other symptoms present.

DISCUSSION.

All observers are agreed that crystallization cannot occur if the intake of fluid is sufficient and the urine is kept alkaline. These factors may, however, be difficult to maintain, especially in a tropical climate, unless very close supervision is constantly exerted. The actual site of the blockage by crystals is held by many to be within the tubules of the kidney, whereas other observers say that the ureters become blocked. From my own observation of the case of this Gurkha N.C.O. I can confidently say that in his case the main blockage was in the ureters. The ureteric orifices were completely blocked by œdema and sheafs of crystals. The kidney operated upon was distended to twice its normal size and, on establishing drainage between its pelvis and the outside, it collapsed to nearly normal size with urine flowing from the nephrostomy tube.

After twenty-four hours of drainage all the œdema had disappeared, and urine was being passed by the urethra from the other hydronephrotic kidney, which quickly began to function again. In this case œdema must have aggravated the obstruction and it is possible that a more restricted fluid intake should have been maintained and hypertonic sodii sulph. administered earlier with probable benefit.

However, œdema had never been a noticeable feature in any of the previous cases and this man would undoubtedly have died had nephrostomy not been performed.

SUMMARY.

(1) An outline of treatment in cases of sulphonamide anuria occurring in healthy individuals has been given.

(2) Anuria in a Gurkha soldier with hydronephrosis has been described in detail.

(3) The site of blockage by crystals has been shown to be primarily ureteric in the one case operated upon.

(4) Though medical treatment will cure the vast majority of sulphonamide anuria cases, there will always be the odd case where surgery may be necessary to save life.

IN CONCLUSION.

My thanks are due to Major John Patterson, R.A.M.C., our pathologist who has had extensive experience of this condition in Burma, for his advice and help in the medical treatment of many of these cases, and to the D.D.M.S. Brigadier C. Scales, M.C., for his permission to forward this article.

A NOTE ON SICKLING AND FLYING.

BY

G. M. FINDLAY, E. A. BOULTER, and C. B. MACGIBBON.

[Received July 22, 1947.]

DURING the past war Africans, in common with other people, found it necessary to fly. Africans served in the R.A.F. while a West African Air Corps took the place of European ground personnel for service in certain tropical areas. Examination of 5,500 West Africans showed that 12.4 per cent had red blood corpuscles which sickled *in vitro* when the oxygen tension was reduced (Findlay, Robertson and Zacharias, 1946). The question, therefore, arose whether sudden sickling would occur *in vivo* when Africans were exposed to a reduced oxygen tension by flying, thus giving rise to an acute and highly dangerous emergency which may end in death (Robertson and Findlay, 1947).

In order to examine this question experiments were carried out in West Africa in 1944 by observing the behaviour of the red cells of Africans with the sickling trait when flying at heights up to 15,000 feet above sea level.

The same problem arose in the United States of America where those of African origin also flew. Henderson and Thornell (1946) found that among negro cadets and combat pilots the incidence of sickling was 7.37 per cent. No evidence was available to suggest that there was an increased elimination of cadets because of the sickling trait. In America the effect of reduced oxygen tension was tested in a low pressure chamber on four subjects with sicklæmia. Two of these had had previous experience of the low pressure chamber. In addition one patient with active sickle-cell anæmia volunteered for a simulated flight while four negroes without sickling were used as controls. All except three subjects were given oxygen at 15,000 feet, while two, taken up to 16,000 feet in the low pressure chamber, were given oxygen after five minutes.

In the patient with sickle-cell anæmia there was a suggestive increase in intravascular sickling as the number of red cells sickled *in vivo* increased from 8 to 15 per cent but the patient himself showed no evidence of oxygen want at 15,000 feet: the three negroes with the sickle-cell trait showed no significant increase in sickling. The icterus index and the urinary urobilinogen remained normal throughout.

In the investigations carried out independently in West Africa the experimental conditions were those of an actual rather than a simulated flight.

EXPERIMENTAL INVESTIGATIONS.

Three African volunteers whose red cells sickled *in vitro* were examined during flight. Before the flight all the volunteers had total red cell counts of between 4 and 5 million per c.mm. Two of the Africans had never had symptoms suggestive of an acute sickling crisis but the third subject had had three attacks of jaundice associated with intense pain in the joints and bones; the last attack had occurred in 1940 before the patient joined the Army. None of the volunteers had ever previously been in an aeroplane so that they had had no opportunity of becoming conditioned to flying. The ground temperature was 85° F. while just above 15,000 feet, the temperature inside the aeroplane was 52° F. The flight in a transport aeroplane began at sea level. Twenty minutes were spent in arriving at 5,000 feet. About fifteen minutes were passed at each height before blood investigations were made. Oxygen was available. The volunteers' bloods were investigated for *in vivo* sickling at ground level, before and after the flight, and at 5,000, 10,000 and 15,000 feet above sea level, by removing blood from a vein in a syringe under paraffin and fixing it in 10 per cent formol saline under a paraffin seal so that the blood was never in contact with the air. In addition, a drop of blood was placed on a cleaned slide, covered with a cover glass and ringed with vaseline while the percentage of red blood corpuscles that had become sickled was noted up to six hours after removing the blood. The volunteers were observed for fourteen days after their flight.

RESULTS.

No necessity for the use of oxygen occurred but the cold caused shivering as no extra clothes beyond tropical kit were worn. Bloods drawn under paraffin and fixed in formol saline showed the following numbers of red cells sickled, 1,000 red blood corpuscles being counted.

NO. OF RED BLOOD CELLS SHOWING SICKLING *in vivo* (1,000 CELLS EXAMINED).

	Sea level before flight	5,000	Height in feet 10,000	15,000	Sea level after flight
Subject A ..	0	0	0	12	4
Subject B ..	0	0	0	50	20
Subject C ..	0	0	0	8	0

It will be seen that at 15,000 ft. there was a slight degree of sickling, most marked in Subject B who in the past had suffered from what were probably acute sickling attacks. The degree of sickling, however, was in all three subjects insufficient to produce symptoms.

It is known that *in vitro* the bloods of different individuals sickle at different reduced oxygen tensions. When bloods taken at different heights were examined for *in vitro* sickling slight differences were noted in the rates at which the red blood cells underwent sickling. The relation between the rate of sickling *in vitro* and the height above sea level at which the blood was removed is shown in the table :—

PERCENTAGE OF RED BLOOD CORPUSCLES SHOWING SICKLING *in vitro* AT ONE TO SIX HOURS AFTER REMOVAL OF BLOOD AT DIFFERENT HEIGHTS ABOVE SEA LEVEL.

Height at which blood was removed	Subject A Hours						Subject B Hours						Subject C Hours					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Sea level	0	0	2	8	15	21	0	0	18	52	70	76	0	0	18	26	35	42
5,000 ft. above sea level	0	3	20	32	34	42	32	55	78	94	98	100	0	4	25	38	44	56
10,000 ft. above sea level	0	18	35	46	50	54	82	94	96	98	100	100	0	22	38	54	60	68
15,000 ft. above sea level	11	28	46	54	56	60	96	100	100	100	100	100	20	38	56	74	84	88

It will be seen that the red cells of Subject B sickled more rapidly than those of A and C, thus suggesting that *in vitro* and *in vivo* sickling run parallel.

Subsequent to their flight none of the three Africans showed evidence of an increase in reticulocytes, an increased icterus index or increased urobilinogen in the urine.

DISCUSSION.

The observations here recorded made during an actual flight, together with those reported by Henderson and Thornell (1946) in the low pressure chamber, show that though reduced oxygen tension *in vitro* causes sickling of the red cells, low oxygen pressures do not necessarily cause excessive or immediate sickling of the red cells while still actually in the vessels. In both the experiments made in America and in West Africa a slight rise occurred in those with a history of sickle-cell anæmia in the number of red cells sickling *in vivo* as shown by blood drawn from the vein and fixed in formol saline in the absence of oxygen, but the degree of sickling was insufficient to cause signs of acute illness such as may occur in sickling crisis.

The factors which precipitate an acute sickling crisis are at present unknown. Hahn and Gillespie (1927) suggested that cardiac and pulmonary diseases reduced oxygen tension and were thus responsible for sickling crises. Findlay, Robertson and Zacharias (1946), however, found that Africans with pneumonia and jaundice did not show a significantly greater incidence of sickling than those with pneumonia but no jaundice. Thus consolidation of part of one lung does not tend to precipitate a sickling crisis and the icterus is probably toxic rather than hæmolytic in character. Though flying for a short time at 15,000 feet does not necessarily induce a sickling crisis through reduction of oxygen tension it may obviously cause an increased rate of sickling and as Africans vary in the reduction of oxygen tension necessary to produce sickling it is possible that sooner or later an African will be found who will sickle when flown at 10,000 or 15,000 feet for a comparatively short time. Such a sickling crisis could probably be aborted by flying at a low level. Those who have had experience of flying in the tropics will, however, be aware that owing to climatic conditions it is often impossible to come down to a low level while aerodromes are few and far between. The administration of oxygen to an African during a sickling crisis does not necessarily alleviate the pain but it does stop the *in vivo* sickling of the red cells. There is therefore an additional

incentive to see that oxygen is carried in all aeroplanes in which Africans are passengers.

CONCLUSIONS.

Experiments were carried out in West Africa to determine whether a flight up to 15,000 feet above sea level, without administration of oxygen, would induce an acute hæmolytic crisis in Africans with sicklæmia.

Three Africans with sicklæmia showed no ill-effects from such a flight, although all showed the presence of sickled red cells at 15,000 feet above sea level after ten to fifteen minutes at this height.

Differences in the rate at which sickling occurred *in vitro* in different individuals were noted and are correlated with the *in vivo* findings.

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Correspondence.

SIR,

On page 60 of the February number of this Journal, Lieutenant-Colonel R. Gwyn Evans refers to "The development during the hot summer months of a foot condition amongst tank crews in which the clinical signs consisted of pain, redness and œdema of either one or both ankles, combined with small hæmorrhages. Their interest lay in the severity of the condition after what must have been a comparatively short space of time in which crews were compelled to stand continuously in a confined and overheated space, the obvious cause of the condition."

It would be interesting to hear comments on this from medical officers with long experience of armoured warfare.

This condition gave us a lot of trouble in 9th Armoured Brigade at the Battle of El Alamein, and during the prolonged tank fights at Miteriya Ridge and Tel el Aqaqir some 70 to 80 per cent of Grant and Sherman tank commanders suffered from it; whilst Crusader tank commanders, who can sit in their tanks during battle, were rarely if ever affected. Marked œdema or brawny painful swelling extended in some cases well up the thighs; was often associated with considerable fever of which it seemed to be the only cause; and often necessitated admission to a medical unit. I personally saw no case with hæmorrhages. As the condition was much more common in officers we suspected a connexion with the rubber-soled thin "desert boots" which they wore; but the real reason for its preponderance in officers was obviously the fact that fewer other ranks were tank commanders.

The condition, as Lieutenant-Colonel Gwyn Evans says, is caused by

prolonged standing in a confined space, and much the same effects were reported amongst men who had to stand for long periods in train corridors.

We thought that the continuous current of cold air which is drawn in through the turrets of tanks causing chilling of the commanders' legs might be an aetiological factor.

I advised our tank commanders to take every possible opportunity of getting out and lying on the ground with their legs well elevated, but, as tank men are notoriously averse to dismounting during battle, I later concentrated attention on devising a simple sling seat which could be hooked on to the turret and adjusted to the individual commander's needs, and this seemed to give good results in training.

It is, however, not easy to persuade tank commanders to sit during battle, as, when standing, the possibility of footwork gives them better command of the whole field of view.

If the attention of tank designers has not been directed to this problem, then it should be; and another important point is the well-known fact that in battle there invariably protrudes from thousands of pounds worth of armour the most valuable piece of mechanism in the tank—the commander's head quite unprotected in a black beret.

He will seldom use his expensive periscope, but a bullet-proof perspex dome might give him protection from small arms fire and splinters from near misses.

I am, etc.,

F. M. RICHARDSON,
Colonel.

Colonel F. M. Richardson,
H.Q. Hamburg District.
July 16, 1947.

Notice.

THE CONSULTANTS' PRIZE.

THE Consultants to the War Office and the Armies in the Field in the late War have presented a sum of money to the R.A.M.C. in order to found a Consultants' Prize, to be competed for at intervals of one to three years.

This prize will be awarded for the first time in 1948 and will be to the value of 25 guineas. The prize is open to serving officers of the Royal Army Medical Corps, holding a regular or a short service commission.

The first prize will be awarded for an essay of not more than 10,000 words on a professional subject, based on the author's own experiences between 1939 and 1946. It is hoped that these essays will ensure that valuable war experience which would otherwise be lost will be recorded for future guidance and possibly for publication.

Entries should be sent in through the usual channels, so as to reach the Hon. Secretary, R.A.M.C. Prize Funds Committee, R.A.M. College, Millbank, London S.W.1, not later than August 1, 1948.

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Original Communications.

PROTRUDED DISK SCIATICA IN THE SERVICES AND ITS MANAGEMENT.

BY

Captain J. M. POTTER,
Royal Army Medical Corps.
(Graded Neuro-Surgeon.)

(From the Combined Military Hospital, Secunderabad, India.)

[Received August 6, 1947.]

INTRODUCTION.

THIS paper is intended for those doctors who care for the Serviceman. In it is offered a workable scheme for dealing with a common complaint, the refractory sciatic pain due to a protruded lumbar intervertebral disk.

A plea may here be made for the adjective "protruded," for it describes, more accurately than most, the usual state of affairs. .

It is not proposed to deal exhaustively with this now familiar condition. Much has been written on its ætiology, pathology and diagnosis, and the reader who is inadequately conversant with these should refer to papers such as those of Mixter and Barr (1934), Mixter and Ayer (1935) and O'Connell (1943) or to the book on the subject by Bradford and Spurling (1941).

It is therefore assumed that the case has been diagnosed correctly as a protruded disk, and that the other causes of sciatica, especially spinal tuberculosis or new growth and disorders in the pelvis, have been excluded. Special attention should be paid to a rectal (or vaginal) pelvic examination (which should never be omitted) and to the radiological appearance of the lumbosacral region of the spine. A "coned down" lateral view centred on the fifth lumbar vertebra may be useful. The two commonly-involved intervertebral disks, those between the fourth and fifth lumbar vertebræ, and between the fifth lumbar and the first sacral are then seen, and any abnormality, notably loss of joint space, is noted. It should be remembered, however, that the lumbosacral interval is normally a little narrower than those above.

MANAGEMENT.

Intelligent and sympathetic, but firm, management of these cases is of great importance, and the object of this paper is to stimulate interest in this aspect of the disease. Incomplete appreciation of the problem may lead to much that is uneconomical both to the patient and the Service alike.

(1) *Assessment of the Pain.*—Accurate assessment must first be made of the patient's pain and, in a Serviceman, this may be most difficult. It is, however, of the utmost importance.

Any hysterical or deliberate exaggeration must be noted; for "pension neurosis," the "pre-release syndrome" and allied states of the mind are unfortunately present to some extent in a great majority of Service cases. A knowledge therefore of the patient's background, his adaptability to Service life and his social and personal history in general is essential in this connexion.

This is a good reason for the early transfer of cases to a special centre (if there is one). Here the same medical officers will have the advantage of getting to know their patients during the period of conservative treatment. Both the physician, and the surgeon who may later have to operate, will see the case at intervals.

(2) *Conservative Treatment.*—It is my practice to put all these cases to strict bed rest for one month right away; and the rest must be strict.

In the absence of a definite history of the pain being worse at rest (a not very uncommon symptom, and a useful one, for it usually means that the pain as described is quite genuine), any man found up and about after the initial and a subsequent warning to rest strictly, can reasonably be considered to be suffering relatively mild pain.

The genuine case will readily avail himself of enforced rest if it relieves or controls his pain.

To one who has had experience of both civilian and military patients together in one ward, the difference regarding pain was noticeable. The latter were harder to assess. (Reference to this difference between the two classes of patients will be made again later in connexion with the results of operation.)

Clearly then, views on sciatica must be modified a little when dealing with Service personnel.

For the pain, analgesics, short of morphine if possible, may be necessary. Often aspirin is sufficient, but full doses may be required six- or even four-hourly. For severe cases combination with codeine is useful. The latter may be given by injection of the phosphate ($\frac{1}{4}$ to one grain in a solution of one grain in fifteen minims). The psychological effect of injections may be marked in a patient who considers that repeated aspirin is insufficient. Occasional morphine may, however, be necessary.

Physical methods of treatment should be confined to those that are appreciated. Hot-water bottles and radiant heat, although usually comforting, may aggravate the pain.

Patients produce many bizarre methods of relieving their pain, and these should be encouraged. Opportunity should be given, to those who desire it, of sleeping at night in a comfortable chair, when in the acute stage of the pain.

Occasionally a patient prefers a hard bed with fracture boards, or even the floor! Sympathy must also be extended to those who are obliged at night to walk round the ward at intervals to effect some relief.

The night is usually a bad time for the man with acute sciatica, and he must not be forgotten at that time. Many an apparently trivial point may mean much to the true sufferer. Consult the patient, therefore, regarding these aspects of his treatment.

It is worth while to treat any diarrhoea promptly, and irritating purges should be avoided. These seem liable to aggravate the pain, possibly by the pelvic inflammation they produce, and by the effort of repeated defæcation.

Any scoliosis or hip-flexion deformities should be corrected when the acute pain has passed off. This can generally be done by exercises, but manipulation later under anæsthesia may be necessary. Cases with severe deformities, however, are usually candidates for operation.

It must be remembered that these deformities are natural methods of relieving the tension on the spinal nerve affected, and the desirability of correcting them must be carefully considered, and the correct stage at which to do it.

Epidural saline injections have not been found satisfactory; possibly due to a poor technique, but in connexion with this and various other auxiliary remedies advocated, the words of Walshe are notable: "It must be admitted that their frequent failure is often to be attributed to their use *as a substitute* for the only really essential element in the treatment, namely an adequate period of rest in bed."

The writer of this paper, however, believes that surgical operation is another essential element in the treatment, when it is indicated, but that does not diminish the wisdom of those words which continue: "Rest is monotonous, lacks the impressiveness of electro-mechano and 'ray' therapy . . . yet an adequate period of rest is not seldom far more economical in the long run than changing over from one method of active treatment to another."

The cause of any obvious hysterical exaggeration of symptoms should if possible be ascertained, but it is likely to be difficult to remedy satisfactorily if it consists of a desire to leave the Service or to obtain a pension. Inquiry into domestic matters may be revealing, and, if this is so, the help of the welfare officer of the man's unit should be invoked.

After a month in bed the milder cases, especially those whose first attack it is (these are the commonest) should have cleared up sufficiently for them to return to duty after a week of graduated exercises. These may commence in bed after the pain has subsided. Those with a little residual disability may require temporary downgrading.

Attention to the limp habit is important at this stage, for later it will be less easy to correct.

Those whose pain really persists after one month or returns when they get up require complete reassessment. This should be concerned specially with any change in physical signs. Improved signs without change in the pain will arouse the suspicion that all is not quite genuine.

Those who, it is considered, are relatively unrelieved are ordered a further

month in bed. Complete immobilization in a plaster of Paris bed may even be desirable, but it is not proposed to lay down definite rules for this procedure since the individual case must be considered.

If after this there is still little or no improvement, those cases not suitable for operation should in my opinion be invalided. These must regrettably include those who are exaggerating a minor but definite disability. All these patients will otherwise almost certainly remain the despair of the Regimental or M.I. Room Medical Officer, and a liability to the Service.

By invaliding a patient, one is not necessarily denying him the chance of operation by an expert later, should he then really require it. A note that he may or will require further treatment should, therefore, be entered in the Medical Board Proceedings.

With Indian or Colonial troops circumstances are usually different, and these circumstances and relevant factors must be carefully considered before the man is sent away to his village.

These invalided patients who are still suffering some disability may benefit from immobilization in a plaster of Paris jacket, applied in the position of maximum comfort and strong enough to last with reasonable care for two or three months.

In less severe cases a man may even be returned to his unit in a jacket for sedentary duties in category "C" for three months. These jackets, needless to say, must be well fitted and comfortable.

Others who have improved further with two months' rest will require graduated exercises and may return to duty in a suitable category.

It should be borne in mind here that pain and physical signs becoming *worse* over this two-month period should arouse suspicion of a neoplasm (of the cauda equina or neighbouring structures). The spine and pelvis should be reviewed, and a low lumbar puncture, spinal manometry and examination of the cerebro-spinal fluid done.

(3) *Operation*.—This final and radical method of treatment must now be considered. It is a good working rule not to operate on Servicemen unless it is considered absolutely necessary. Modification of this rule may be made in the less severe case whose symptoms are beyond suspicion.

Observance of the rule will save many useless operations, and not a few that are damaging alike to the patient and to the art of surgery.

The operation requires peculiar skill if it is to be done with the minimum of damage to normal parts and render recurrence unlikely. It is rightly the province of the expert or, in his absence, those trained by him.

Inexperienced and indiscriminate operators can do harm to cases which might otherwise cure themselves eventually with less discomfort and disability. The surgeon's interest in these cases should never be such that they are regarded only as candidates for the knife. (It should surely be unnecessary to feel obliged to say this, even though the often humdrum work of the Army general surgeon is well appreciated.)

(It may be emphasized that there is no attempt here to make a mystery of this operation. The convictions of the writer are merely expressed.)

The alternatives confronting the surgeon are less likely to be "invaliding or operation", than "invaliding or operation followed by invaliding"; for the proportion of cases that return to duty is not satisfactory, and it is a shrewd man who can predict before operation which they will be.

It must be realized that this major operation is in itself a good excuse for complaints of pain and disability afterwards. These are not easy for the fair-minded surgeon to ignore. This is particularly true, in the writer's experience of Indian and African troops. The former seem very liable to post-operative hysterical conditions. The pain may, however, be quite genuine.

Better results have been obtained in civilians than Service cases. How much longer this will be so these days remains to be seen.

(4) *Indications for Operation.*—What then are the indications for the excision of a protruded lumbar intervertebral disk in a Serviceman?

O'Connell (1946) has summed the matter up well as regards patients in general, and his useful paper should be read by all those interested.

His emphasis is on *severe pain, severe neurological signs and severe tension signs*.

When these symptoms and signs are of lesser severity, but nevertheless causing a certain amount of disablement, fine judgment is required in assessing the suitability for operation. For the reasons already mentioned this judgment must be particularly acute in Service cases.

Definite indications therefore are:—

(a) *Indisputably severe or disabling pain* prolonged for, or recurring over a period of at least two months, during which time strict bed rest has been observed. (O'Connell says three months, but in Service cases a decision should be made earlier if possible.)

Cases with previous attacks will naturally have a stronger claim to operation than those whose first attack it is.

(b) *Severe neurological signs*, such as marked involvement of the cauda equina, or great weakness in one or both limbs, notably such as to cause foot-drop. Indications from these alone are uncommon.

(c) *Severe tension signs*: These include severe limitation of straight leg raising, combined usually with marked limitation of spinal movement. Co-existing, there may be marked scoliosis and hip-flexion deformity.

These signs should be of at least two months' duration, impossible to correct by other means and preferably a combination of two of the factors above. In practice (a) and (c) combined are the common criteria for operation.

For those on whom operation for any reason seems undesirable, but who require treatment, manipulation may be tried. This should be gentle, obtaining full spinal movement gradually and flexing the extended legs individually at the hip. The results are not always satisfactory. Clumsy and rough manipulation should be avoided as it may increase the size of an existing disk protrusion and exacerbate the symptoms.

ENVOI.

In conclusion the emphasis must be again on the genuine patient and the conservative surgeon. It may be said that much in this paper is physicians' talk. If so, it is all to the good, for it may then be realized that sciatica requires more the outlook of the enlightened, modern physician than that of the surgeon. Too many cases now go direct to the surgeon.

It is hoped that the extent of the subject has been appreciated; for this paper has been concerned with but the management of the condition. In it there is much to interest the "specialist in sciatica," and even if his results are often disappointing, there is much that can be done or tried for these rather unfortunate patients.

The eagerness with which cases are transferred to a special centre, and the "bit of nuisance" that this type of case is often considered to be are noticeable. This paper is intended to stimulate more interest in and appreciation of the problem.

The subject is not too difficult if one really knows one's patient, as, after all, every good doctor should.

For permission to publish this paper it is a pleasure to thank my Commanding Officer, Colonel E. Percival, who has always shown such a helpful interest in the cases under my charge.

From the clerical point of view, the help I have received from Havildar Clerk A. Menon, I.A.M.C., has been considerable and always unfailing.

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REPORT ON NUTRITION, AND DISCUSSION OF THE MAIN CAUSES OF DEATH, "F" FORCE, THAILAND.

BY

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[May, 1943 to April, 1944]

INTRODUCTION.

SINGAPORE surrendered to the Japanese on February 15, 1942. From time to time thereafter, many of the British and Australian Prisoners of War were sent away to unstated destinations, either overseas or overland. At the beginning of April, 1943, the Imperial Japanese Army informed P.O.W.H.Q. at Changi Camp that another 7,000 men were to leave Singapore by rail in the near future. This force was subsequently known as "F" Force.

The writers of this report had been employed in the Malayan Medical Service before the campaign in Malaya, J. A. R. being an Entomologist in the Institute for Medical Research, Kuala Lumpur, and T. W. being Health Officer, Malacca. We were detailed to accompany "F" Force as advisers on antimalarial work and nutrition.

We have thought it necessary to broaden the scope of our report by including, in addition to our observations on nutrition, a section which deals with sickness and deaths in general; and we have prefaced the body of the report by a narrative describing the conditions encountered in Thailand. We end by expressing an opinion as to the main cause of the extremely high death-rate registered by the Force.

Health Prior to Leaving Singapore.—The death-rate of the British and Australian Ps.o.W. left on the island for the first twelve months following the surrender was 13.1 per 1,000 (548/31750).

Sickness rates in all camps were considered high. Most of the sickness in the early months was due to bacillary dysentery.

Later, there were small outbreaks of malaria and dengue, and a widespread prevalence of beri-beri and of diseases attributed to deficiency of vitamin B₂ complex, namely scrotal dermatitis, stomatitis and glossitis, "painful feet" and spastic paraplegia, keratitis and amblyopia, and a few cases which were regarded as pellagra.

Both in Changi, which was not a working camp, and in the working camps elsewhere on Singapore Island, the official Japanese-issued diet was rather poorer than that of the average Asiatic labourer in Malaya. It had been improved only for a period of two and a half months in October to December, 1942, when Red Cross supplies were being consumed. At other times it was possible to supplement the rations by canteen purchases at fairly reasonable prices, but

not to an extent sufficient to offset the dietary deficiencies of the official scale of rations.

There can be little doubt that even the fitter troops comprising "F" Force were well below normal physically, and probably also mentally, as a result of their imprisonment before leaving for Thailand. In addition to these men, however, a considerable number of definitely unfit men were sent with the Force in conformity with the preliminary I.J.A. orders.

These orders stated that:—

(a) It was not to be a working party. (b) There would be no marching except from the train to near-by camps. (c) The new camps were healthily situated, and food would be better there than at Changi. (d) 30 per cent of the number could be unfit men. (e) A medical party was to be taken, with equipment for 400 patients, and three months' medical supplies. (f) Transport for baggage and for unfit men would be provided at the end of the railway journey.

Apart from these items, encouragement was given to the taking of a lighting set, and musical instruments, including pianos, for a concert party. The destination of the Force was kept secret.

DESCRIPTIVE NARRATIVE.

The Railway Journey.—The 7,000 men and the stores were divided into 13 train loads, which left Singapore at twenty-four-hour intervals, commencing April 16, 1943. The railway journey was a tiring one of approximately 1,200 miles and took four to five days. During this time, 27 to 28 men (with all their belongings) were penned inside steel rice trucks measuring 18 feet by 7 feet; they were allowed only brief intervals of freedom outside the trucks.

Arrival in Thailand.—The members of each train party detrained at Banpong, a town in Thailand on the main Singapore-Bangkok railway some 45 miles west of Bangkok. They then had to march about $\frac{3}{4}$ mile to a very dirty reception camp, leaving their heavy baggage at the railway station. Immediately afterwards they were told that a long march lay ahead, and that everything which could not be hand-carried would have to be left behind in a baggage dump near the station.

This was the first brusque intimation of the vast difference which existed between the expectations aroused by the original I.J.A. orders and the realities of the situation in Thailand. The extent of this difference could, however, only be fully appreciated at a later date. The true facts were:—

- The men were required for the heavy manual labour involved by the preliminary earth cutting, embankment making, quarrying, and bridge building on a section of a new railway line then being constructed. This line was to link up Nompradok, 30 miles west of Bangkok on the main line, with Tanbazar in Burma, on the railway between Moulmein and Ye, thus joining the railway systems of Thailand and South Burma.

This particular section ran through the practically uninhabited jungle-covered hills south of the Three Pagodas Pass on the Thailand-Burma border. To reach the working camps, the men had to march 170-200 miles over a rough

and hilly earth track, which the monsoon rains soon turned into a river of mud. (The first 60 miles of this march could have been eliminated by using an already completed portion of the new railway.)

The camps were situated in a highly malarious region, and the food provided was decidedly worse than at Changi.

Scarcely any transport for unfit men or for stores was forthcoming. About 75 per cent of the stores, including vitally important medical supplies, remained in the Banpong baggage dump until December, 1943, and were only retrieved then when the survivors of "F" Force returned to Kanburi, a town 30 miles away from Banpong.

Only a few of the sickest men were allowed to stay behind in the Banpong-Kanburi area. The great majority of the unfit men were forced to march with the others, and proved to be a severe burden on the rest of the Force.

Conditions on the March.—Practically all the marching was done at night, and the onset of the south-west monsoon rains made things still more difficult for the marchers. The distance to be covered each night varied from 10 to 16 miles; in the early stages every third night was a rest night, but—as one bivouacked in the open—the amount of rest obtained depended upon the weather. In the later stages no rest nights were allowed, and several train parties had to keep on the move for six nights in succession. When a party arrived at a transit camp, it then had to provide men for firewood and water fatigues; the rest of the day could be spent under hastily rigged shelters of groundsheets and plantain leaves, either sheltering from the heat or trying to keep oneself dry. Not unnaturally, sickness increased by leaps and bounds, and the medical staff were kept constantly busy.

The guards at the various transit camps showed no interest in, or concern for, the sufferings of the prisoners. Their one idea seemed to be to force everyone who could stand on his feet to move on to the next camp. This meant a double burden on the fitter men, and many of these who might have managed to keep going fairly well on their own, exhausted themselves by their efforts to help the unfit.

The strain of carrying personal belongings, medical supplies, and food containers, and of assisting the numerous unfit men, heavy as it was at the beginning, later became almost unbearable. Days became weeks and still the weary journey through darkness, rain, mud, and tropical heat, continued. It was with feelings of relief, unfortunately fated to be very short lived, that each party finally arrived at its destined working camp 170 to 200 miles into the jungle, and 19 to 22 days after leaving the railway trucks.

The importance of the march from our point of view lies in the extreme exhaustion which was included by excessive exertion carried out on miserably inadequate food, an exhaustion which was increased by the pain of blistered and septic feet, and by the weakness resulting from the onset of dysentery and diarrhoea, all very common complaints right from the early stages.

Conditions at the Fixed Working Camps.—The camps were clearings in the jungle in which huts had been built. The hut framework was made of large bamboos or jungle saplings, the walls were of split bamboo: sleeping

benches of split bamboo—often in two tiers—were ranged on either side of a central earth gangway. Roofs, where they existed, were of attap or large leaves from jungle trees, and leaked in many places. Overcrowding in some camps was excessive, 12 to 14 men having to occupy each section or "bay" of the sleeping platform measuring 10 feet by 13 feet.

Latrines were the open type. Water for all purposes was obtained from the nearest stream or river.

Some camps had just been vacated by Thai, Burmese or Indian labourers, and were incredibly filthy. Workers for the railway, and for patching and corduroying the existing earth road, were demanded immediately after arrival: no time was given to make the camps habitable, or to allow the men to recover from the strain of the march. Bad weather, muddy surroundings, and a shortage of men and tools, made camp maintenance and hygiene wellnigh impossible at several camps. Without firm paths to the latrines, it was difficult to reach them in a hurry, especially at night; this fact, combined with the poor hygienic training of many troops and the outbreak of cholera and dysentery, soon made the state of such camps almost indescribable.

Working Conditions.—Working conditions were hard in the extreme. No rest days were given, and so long as a man remained fit he would be working from daylight to dark. For weeks on end many men never saw their camp by daylight, and never managed to dry their clothes. Foot complaints, tinea and sepsis, became a serious problem.

The I.J.A. demands for workers were so excessive that many men had to go out to work who should have been in hospital. The medical officer taking sick parades had the unenviable task of trying to decide—either in half-darkness or by the light of a fire or a flickering candle—as to which of the many unfit men could carry on for a few days longer without serious damage to their health. Failure to produce the required number usually meant a loss of temper all round and a face slapping for the persons held responsible. It might, and often did, entail a parade of sick at which the I.J.A. guards and engineers made the decisions about a man's fitness for work, and completely ignored the medical officer's opinion—we ourselves saw at one camp men crawling on all fours, and being carried out to such parades. On several occasions it meant that sick were taken out of the hospital wards by the guards and sent to work. There was no such thing as a proper period of convalescence after an illness. Men would be discharged from hospital one afternoon and be at work next day.

As a result of all this, there developed an understandable tendency for men to delay going on sick parade until they were almost unable to walk, a tendency which was reinforced by the desire for the extra food given to workers, but which must have had a deleterious effect during the subsequent illness.

Conditions in Camp Hospitals.—Use of the words "hospital" and "wards" is liable to give a wrong impression. The wards were simply huts similar to all the others, and occupied by sick men; a hospital was a group of such huts. Overcrowding in them was just as bad as in the workers' quarters. There, as elsewhere, the only illumination was provided by bamboo fires kept burning continuously in the central gangway on the mud floor.

At the Tanbaya and Kanburi Hospital camps, workers were required only for camp duties, and there was not quite so much congestion; other conditions were much the same as in the working camps.

Lack of Drugs and Appliances.—With the solitary exception of quinine, there were never sufficient quantities of drugs, dressings and medical appliances. For months at a time, acute dysenteries had to be treated with home made charcoal, and tropical ulcers had to be dressed with green leaves. Rice polishings for the prevention and treatment of beri-beri were supplied only at Tanbaya Hospital and only from the end of October onwards; elsewhere a few vitamin B, ampoules and small amounts of dried yeast powder were all that was forthcoming.

Dressing bowls, bedpans, urine bottles and other containers all had to be made from bamboo; at least one medical officer improvised complete intravenous saline sets for his cholera patients from bamboo containers and cannulæ joined together with stethoscope tubing.

Lack of Medical Comforts and Special Diets.—Most of the reserve stocks of Red Cross stores taken with the force also remained at Banpong, and little could be done elsewhere to provide special diets even for the sickest patients. This meant that in order to give himself a reasonable chance of survival, it was imperative for the sick man to eat every scrap of his meagre ration, whether he wanted to or not; possibly this fact was not sufficiently widely recognized by the medical staff nor sufficiently impressed by them upon the minds of their patients. It was striking to see the rapidity with which comparatively healthy-looking men lost weight and strength in a few days as a result of fever or diarrhœa combined with loss of appetite; by contrast, recovery was slow and tedious.

The Tanbaya Hospital, Burma.—In July, 1943, the I.J.A. attempted to cope with the problem of sickness by establishing a new camp in Burma, to which those men likely to be unfit for work for a considerable period could be sent to recuperate. The return of the sick to Kanburi by river, and the bringing up of supplies by the same route, would have been possible at that time and would have been more sensible, but the move to Burma duly took place. It involved about 2,000 of the sickest and most debilitated men. The journey took two and a half to three and a half days actually travelling, but some parties were delayed at staging camps *en route*. Although this camp was linked to Moulmein by the new railway, food was very little better than at the working camps, and other supplies were just as scarce.

Morale.—The imponderable factor of morale is important when men have to face adversity. During the march morale was high, sustained by the knowledge that we must arrive somewhere and the hope that conditions there might be reasonably good.

It deteriorated rapidly under the influence of bad living conditions, bad weather, poor food, exhaustion and illness, particularly during the cholera epidemic. Naturally, rumour was always rife and spirits would soar with each fresh tale of an early return to civilization, only to fall again still lower as weeks went by and no signs of a move could be seen. It was a vivid illustra-

tion of hope deferred making the heart sick, and a yielding to hopelessness and despair—in common parlance "dropping one's bundle"—came to be a final factor in many deaths.

NUTRITION

Rations.—Ready-cooked food was supplied during the five days' train journey from Singapore, and the three weeks or so of the march. The meals consisted of boiled rice, and watery vegetable stews containing a few pieces of cucumber, pumpkin, or onion; they only sufficed to stave off the pangs of hunger for a few hours. The usual issue was two meals per day, plus some cold rice and occasional pieces of dried fish as a haversack ration for the midnight halt. The I.J.A. refused to change our Malayan money into Thai currency, but a brisk—though illicit—trade in personal possessions soon developed, and with the money thus obtained extra food could be bought from hawkers during the first week of the march. Even with this addition, however, few men were able to maintain weight and strength over this period of exertion.

At the fixed camps, the I.J.A. supplied uncooked rations. Theoretically the ration scale was the same as at Changi, but in practice the amounts handed over each day varied according to the stocks in hand, the state of communications with the outside world, and the mood of the Japanese Quartermaster. Another very important cause of variation was the idea apparently held by many of the Japanese officials, and at times openly expressed by them that sickness—even if not merely feigned in order to evade work—was a gross breach of discipline and an act of sabotage against the Japanese war effort, almost deserving of punishment. Instructions were actually issued officially from the I.J.S.H.Q. fixing a scale of 600 grm. rice daily for those working directly for the I.J.A. on the road and railway tasks; 500 grm. rice daily for those employed on camp duties; and only 200 grm. daily for those classified as sick or unfit for duty. As sick men and convalescents always outnumbered the workers, sometimes by three or four to one, the enforcement of this order meant a considerable reduction in the total amount of food issued to a camp. Although some adjustment and improvement of the sick men's rations was usually possible in our own cookhouses, the manual workers could not be penalized too much for the benefit of the sick.

Items such as potatoes and preserved meat provided still another cause of variation. The Japanese QM. would issue a number of bags or boxes of these commodities with a lofty disregard for their fitness for consumption, and this total number would be shown in his records. Bags of potatoes suffered greatly from soaking during transport and storage, and many were only fit for the refuse pit. The preserved meat—a coarse-fibred meat, possibly buffalo meat, without the bone—was partially salted or pickled, and arrived packed in boxes. It usually swarmed with blow-fly maggots and frequently was in such an advanced state of decomposition that it dripped, a grey-green liquid, out through the seams of the boxes; only one boxful of pieces worth cooking might be salvaged out of four or five boxes issued. (We may add that the standard of fitness for consumption was well below anything that we would have held before becoming prisoners, and a good deal below the standard in Changi.)

The rice was a highly milled Burma rice, and both it and the dried beans were heavily infested with weevils.

Cattle which had been driven on foot all the way from Burma provided the fresh meat; they were just as exhausted by their walk as were the prisoners, and were frequently slaughtered when already in a dying condition.

Supplements to the Ration.—It was impossible to supplement the rations at all adequately by local purchases. The only trading centre in the neighbourhood of the working camps was Nieke Village, and the one storekeeper with whom dealings were allowed had a poor selection of foodstuffs at high prices. Palm sugar cost 40 ticals (Thai dollars), and coconut oil 35 ticals per 4 gallon tin; canned herrings were $2\frac{1}{2}$ to 3 ticals per 15 oz. tin. (The men received $\frac{1}{4}$ tical, 25 cents, per day only while working; sick men received no pay.) The camp hospitals had first claim on any more valuable foods, like dried green grams, but the amounts which could be purchased were never sufficient to make an appreciable difference to the food value of the camp ration as a whole, until after the return to Kanburi at the end of November, where food was plentiful and reasonably cheap.

Green leaf vegetables were, of course, quite unobtainable at the working camps, but I.A.R. was shown some wild edible green leaves by a Burmese at Nieke. A large patch of one of these plants was found near-by and sufficient was collected daily to add to the stew for the whole camp. It was a leguminous plant, popularly known as "wild peanut," and later identified as a species of *Cassia* (Family Leguminosæ).

Near Sonkurai camp, a large area of ground was covered with a species of wild gourd akin to a loofah (Family Cucurbitaceæ), the leaves of which made a very pleasant green vegetable when cooked. We showed this plant to the officers at the camp, and suggested its general use.

At Kami-Sonkurai, little wild gourd or wild peanut was to be found, and we were dependent on the leaves of a climbing plant common in the vicinity, which was not identified with certainty, but it is thought to belong to the family Sterculiaceæ. The leaves are large and hairy, but fairly soft when boiled, and produce a syrupy soup. Parties were organized to pick these leaves daily, and, for lack of something better, special quantities were given to men suffering from beri-beri.

All these supplements combined can have made such a slight addition to the diet in general, except in Kanburi, that we have not taken them into account when calculating the food values of the diets.

Collection of Data.—(a) All issues were by bulk, and none of the camps possessed weighing machines. The figures in Tables I and II have therefore been derived from estimates of weight of the various articles. These estimates were made at the time by the British and Australian "Q" staff, all of whom were men accustomed to handling food and estimating weights by bulk, and should be reasonably accurate. Exact figures of daily strengths were available at each camp, and these have been averaged over the period detailed in the tables.

(b) The figures given are the nett amounts of edible food received as rations

by the prisoners, and may be expected to differ quite considerably from the Japanese records of food issued, for the reasons given above.

(c) Ration figures for the camps visited were collected on the spot, while others were obtained later from the "Q" staff of other camps who had had enough paper to keep records. One Quartermaster replied to our request for information by stating that he had had to keep his records on the shoulder blade of an ox, which he had not brought back to Changi with him.

(d) The dietary analysis in Table II are as complete as we can make them at present, but may require revision later, when we can consult fuller food tables than we now possess. However, we are satisfied that the general picture is reasonably correct, and they are directly comparable with the Changi diets for which the same analysis figures were used. We have made no allowance for wastage either in cooking or absorption.

Remarks on the Diets.—(a) Rations for June and early July were particularly poor. This was at a time when some camps, notably those at Nieke and in the Konkoita area, were almost deprived of communication with the outside world. No adequate reserve stocks had been laid in before the rains began, and, as it was uncertain how long it would be until fresh supplies could come through, rations were cut drastically. For about a week at Nieke in the middle of June the whole camp was receiving 270 gm. white rice, 24 gm. dried lima beans, 15 gm. dried green grams, and about 50 gm. fresh meat (inclusive of bone) per head per day. This works out at an energy value of 1,200 calories, rather less than the amount considered necessary for basal metabolism. At about the same time the Konkoita camps for 8 to 10 days were on a diet of 300 gm. rice and a little salt daily, varied occasionally by omission of the salt. On such food men were compelled to do heavy manual labour.

(b) The later months showed a gradual improvement in energy values except where there was discrimination against the sick men, but only once did the value reach a reasonable figure for the type of work being done.

(c) Approximately 80 per cent of the total energy was supplied by carbohydrate, and 90 per cent of this carbohydrate was derived from highly milled rice.

(d) Protein usually was small in amount and very little of it was of animal origin.

(e) The amount of fat was inordinately low at all camps.

(f) There was a complete absence of green leaf vegetables and fruit—except at Kanburi—and consequently very low figures for vitamins A and C.

(g) The vitamin B₁ (thiamin) values were well below the estimated normal requirement, except at Tanbaya Hospital from the last week of October, when rice polishings were supplied. The thiamin-non-fat-calorie ratio never exceeded 0.24 at any of the working camps.

(h) The daily requirement of the different components of vitamin B₂ complex is not yet known with certainty. Assuming that the amounts suggested for riboflavin and nicotinic acid are approximately correct, it will be noted that the riboflavin figures, while low, were not so far below the requirement as was the nicotinic acid.

Further Comments on Diet.—In their book, Vitamin B₁ (thiamin) published in 1939, Williams and Spies make several statements so pertinent to our subject that we quote them here in conjunction with points which we wish to emphasize.

Page 85: "The requirements for vitamin B₁ may be distinctly above the average in persons with fever, severe gastro-intestinal symptoms . . . and other conditions." Page 295: ". . . the thiamin requirement during period of severe exertion and possibly during the course of intermittent fever such as malaria may rise considerably above the level adapted to other conditions."

Fever, dysentery or other forms of enteritis, and severe exertion were prominent features of the life in Thailand.

Page 100: "(From animal experiments) . . . the vitamin B₁ requirement rises with the amount of carbohydrate consumed, but fails with increasing proportions of fat in the food."

Thailand diets had an overwhelming preponderance of carbohydrate, contained very little fat, and were gravely deficient in vitamin B₁.

Page 102: "We shall therefore commit ourselves to the thiamin-non-fat-calorie ratio as the best tentative index for protection of the average individual that can be offered at present . . . (while admitting the necessity for further verification of thiamin values of foodstuffs) . . . the thiamin-non-fat-calorie ratio necessary to protect against beri-beri is very close to 0.3."

NOTE.—One obtains this ratio by subtracting the calories derived from fat from the total calories. The balance then represents the calories supplied by protein and carbohydrate. The total amount of thiamin in the diet expressed in micrograms divided by the non-fat-calories is the thiamin-non-fat-calorie ratio.

In analysing the Thailand diets we have used Williams and Spies' figures for the thiamin content of foodstuffs, except for the rice. For it we allowed 0.5 microgram thiamin per grm., a figure which more closely corresponds to local analyses of this type of rice than their "preferred value" of 0.3 microgram thiamin for highly milled rice. This change in values would have the effect of raising the thiamin-non-fat-calorie ratio of these diets well above a similar calculation made by Williams and Spies; even so, the ratio never exceeded 0.24 at any working camp and was more often below 0.3, i.e. well below the protective level.

The actual figures were:

<i>Thiamin-non-fat-calorie ratios.</i> (N.F. = no figures available.)								
	1943							1944
<i>Camps</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.-Apr.</i>
Konkoita	.. 0.14	0.16	0.17	0.17-0.18	N.F.	0.20	—	—
Nieke ..	.. N.F.	0.21	0.20	N.F.	—	—	—	—
Shimo-Sonkurai	N.F.	0.17-0.18	0.18	—	—	—	—	—
Sonkurai	.. N.F.	N.F.	0.19-0.22	—	—	—	—	—
Kami-Sonkurai	N.F.	N.F.	N.F.	0.21-0.24	0.20	0.23	0.21	—
Tanbaya	.. —	—	—	0.23	0.28	0.31-0.93	0.61	N.F.
Kanburi	.. —	—	—	—	—	—	—	0.27

Summary.—The most striking features of the Thailand diets were the excessive preponderance of carbohydrate, derived mainly from highly milled rice, and deficiencies in protein, fat, and vitamins; with as a corollary a thiamin-non-fat-calorie ratio, which was constantly below the protective level of 0.3.

Given only these details, one could have predicted with certainty that a severe outbreak of beri-beri must develop sooner or later; given, in addition, the widespread occurrence of cholera, dysentery, diarrhoea, and malaria, tragic results were inevitable.

SICKNESS AND DEATHS.

Deficiency Diseases.—(a) *Beri-beri*: An estimate of the amount of beri-beri experienced must depend largely on one's ideas about the causation of œdema. Some people consider protein deficiency, others thiamin deficiency, and yet others a combined deficiency, to be the main cause. The "F" Force M.O.s classified practically all the cases of œdema as beri-beri; accepting this classification, it is no exaggeration to say that almost everyone was suffering from

TABLE I.—DETAILS OF "F" FORCE THAILAND CAMPS DIETS. YEAR 1943

Article	May		June			July		
	Kon-koita 10-31	Kon-koita 1-30	Nieke 7-30	Shimo-Son-kurai 1-30	Kon-koita 1-31	Nieke 1-31	Shimo-Son-kurai 1-31	Son-kurai 6-31
Rice (highly milled) Aver. amt.	537	445	390	—	570	590	—	—
„ Sick in Hospital	—	—	—	386	—	—	390	300
„ Convalescents	—	—	—	—	—	—	531	—
„ Camp duties	—	—	—	—	—	—	561	600
„ Outside workers	—	—	—	474	—	—	586	700
Flour (atta)	—	—	—	6	—	—	—	—
Vermicelli	—	—	—	—	—	—	—	—
Sugar (white)	—	1	—	—	2	—	—	—
„ (palm)	—	—	—	—	—	—	—	—
Rice polishings	—	—	—	—	—	—	—	—
Vegetables (unspecified dried)	—	—	—	—	15	—	—	—
„ Cabbage leaves	—	—	—	—	—	—	—	—
„ Green beans	—	—	—	—	—	—	—	—
„ Green grams sprouted	—	—	—	—	—	—	—	—
„ Onion tops	—	—	—	—	—	—	—	—
„ Onions	12	—	41	28	—	71	19	94
„ Radish	—	—	—	—	—	—	—	—
„ Yams	—	—	—	—	—	—	—	—
„ Pumpkin, etc.	—	—	—	—	—	—	—	—
„ Egg plant	—	—	—	—	—	—	—	12
„ Potatoes	—	—	—	—	—	—	—	—
„ Sweet potatoes	—	—	—	—	82	41	—	—
„ Dried Lima beans	—	4	60	11	—	60	49	54
„ Dried yellow dhalls	—	—	—	11	—	—	—	—
„ Dried green grams	1	2	—	—	9	—	—	—
Prawns (preserved)	—	—	—	—	—	—	—	—
„ (dried)	—	—	—	—	—	—	—	9
Whitebait (dried)	1	1	—	—	—	—	—	—
Fish (dried)	—	—	14	11	4	12	16	81
„ (canned herrings)	—	—	—	—	5	—	—	—
„ (fresh)	—	—	—	—	—	—	—	—
Beef (fresh) $\frac{1}{2}$ carcass	1	46	32	41	10	15	41	28
„ (preserved)	—	—	—	—	—	6	—	—
Pork (fresh)	—	—	—	—	—	—	—	—
Poultry (fresh)	—	—	—	—	—	—	—	—
Eggs (fresh duck)	—	—	—	—	—	—	—	—
Oil (peanut or coconut)	—	—	1	1	4	—	—	—

incipient beri-beri. Many men otherwise fairly well had persistent œdema of the feet and legs for months on end; with the great majority, all that was needed to bring on œdema was an attack of malaria or the onset of diarrhœa or dysentery. A number of patients developed a generalized massive œdema and became enormously swollen, resembling the familiar rubber man in the Michelin Tyre advertisement.

There were many cases of acute cardiac beri-beri with the classical signs and symptoms; and other cases of sudden collapse and death which were attributed to the same cause, the victims as a rule being men who had been ill for several days with some acute disease, and had started to recover.

Numbness of the feet and legs was a common accompaniment of œdema, but very few cases of fully developed neuritic beri-beri were observed.

(b) *Tropical Ulcer*.—This has been regarded as a deficiency disease, but it remains uncertain whether general underfeeding or lack of a specific food factor

FIGURES ARE AMOUNTS IN GRM. PER MAN PER DAY.

Article	August				September		
	Konkoita 1-16	Sonkurai 1-31	Kami- Sonkurai 17-31	Tanbaya Hosp. 4-31	Sonkurai 1-30	Kami- Sonkurai 1-30	Tanbaya Hosp. 1-30
rice (highly milled) Aver. amt. ..	—	—	608	590	—	654	573
Sick in Hospital	298	—	450	—	—	—	—
Convalescents	—	—	—	—	—	—	—
Camp duties	—	—	600	—	—	—	—
Outside workers	682	—	750	—	—	—	—
our (atta)	—	—	1	16	—	10	1
rmicelli	—	—	—	—	—	—	—
gar (white)	—	—	—	11	—	—	4
.. (palm)	—	—	—	—	—	—	—
ce polishings	—	—	—	—	—	—	—
getables (unspecified dried) ..	14	—	—	—	—	—	—
.. Cabbage leaves	—	—	—	—	—	—	—
.. Green beans	—	—	—	—	—	—	—
.. Green grams sprouted	—	—	—	—	—	—	—
.. Onion tops	—	—	—	—	—	—	—
.. Onions	—	—	—	—	—	—	—
.. Radish	—	—	—	—	—	—	—
.. Yams	—	—	—	—	—	—	—
.. Pumpkin, etc.	—	—	—	46	—	—	150
.. Egg plant	—	—	—	—	—	—	—
.. Potatoes	—	—	—	—	—	—	—
.. Sweet potatoes	18	—	1	88	—	128	200
.. Dried Lima beans	—	—	60	30	—	35	20
.. Dried yellow dhalls	—	—	—	—	—	—	—
.. Dried green grams	8	—	31	18	—	—	10
awns (preserved)	—	—	—	—	—	8	9
.. (dried)	—	—	—	—	—	—	—
hitebait (dried)	—	—	3	—	—	8	—
sh (dried)	1	—	—	2	—	6	1
.. (canned herrings)	—	—	—	—	—	—	—
.. (fresh)	—	—	—	—	—	—	—
ef (fresh) $\frac{1}{2}$ carcase	36	—	—	153	—	7	20
.. (preserved)	—	—	33	—	—	65	73
ork (fresh)	—	—	—	—	—	—	—
oultry (fresh)	—	—	—	—	—	—	—
eggs (fresh duck)	—	—	—	—	—	—	—
il (peanut or coconut)	2	—	—	5	—	—	1

[continued on p. 160]

is the cause. An accurate estimate of the proportion afflicted is difficult to obtain. In the later months probably 80 per cent of people had ulcers of some sort, most of which had started from an infected scratch, spread rapidly, and were slow in healing. By this time everyone had scabies and was louse infested, so that scratches were not necessarily sustained at work; even bedridden patients could produce ulcers as a result of scratching themselves.

Those who died from tropical ulcer had suffered agony for months, but a considerable number of ulcer patients who survived the train journey back to Kanburi ultimately recovered under the influence of the better food and better treatment available there.

At the Tanbaya Hospital in Burma, and at Kanburi, notably better results of treatment, and decreased incidence of fresh ulcers, were observed following the arrival of adequate quantities of rice polishings; there had also been, just previously, an increase in dietary protein in the form of dried beans, but the M.O.s concerned dated the marked improvement from the time of the appearance of the rice polishings.

TABLE I.—Continued

Article	October				November		Dec. 17, 19 3
	Kon-koila 1-31	Son-kurai 1-31	Kami-Son-kurai 1-31	Tan-baya Hosp. 1-31	Kami-Son-kurai 1-17	Tan-baya 1-17	Mar. 31, 19 9
Rice (highly milled) Aver. amt. ..	649	—	648	545	731	590	434
„ Sick in Hospital	—	—	—	—	—	—	—
„ Convalescents	—	—	—	—	—	—	—
„ Camp duties	—	—	—	—	—	—	—
„ Outside workers	—	—	—	—	—	—	—
Flour (atta)	—	—	2	2	4	6	—
Vermicelli	—	—	1	—	3	—	—
Sugar (white)	—	—	—	6	—	11	19
„ (palm)	—	—	8	—	27	—	—
Rice polishings	—	—	—	14	—	40	—
Vegetables (unspecified dried)	57	—	—	—	—	—	—
„ Cabbage leaves	—	—	—	—	—	—	50
„ Green beans	—	—	—	—	—	—	25
„ Green grams sprouted ..	—	—	—	—	—	—	30
„ Onion tops	—	—	—	—	—	—	30
„ Onions	—	—	—	—	2	—	—
„ Radish	—	—	—	—	—	—	35
„ Yams	—	—	—	—	57	—	—
„ Pumpkin, etc.	—	—	4	114	—	20	30
„ Egg plant	—	—	—	150	—	—	25
„ Potatoes	—	—	22	—	105	—	—
„ Sweet potatoes	—	—	374	64	233	30	30
„ Dried Lima beans	—	—	25	—	—	96	—
„ Dried yellow dhalls	—	—	—	40	—	—	—
„ Dried green grams	2	—	—	—	—	60	—
Prawns (preserved)	—	—	24	27	—	—	—
„ (dried)	—	—	18	—	12	—	—
Whitebait (dried)	—	—	3	—	—	—	—
Fish (dried)	57	—	—	2	—	3	—
„ (canned herrings)	—	—	—	—	—	—	—
„ (fresh)	—	—	—	—	—	—	4
Beef (fresh) $\frac{1}{2}$ carcase	27	—	21	41	63	31	2
„ (preserved)	—	—	29	36	20	38	—
Pork (fresh)	—	—	—	—	—	—	8
Poultry (fresh)	—	—	—	—	—	—	1
Eggs (fresh duck)	—	—	—	—	—	—	20
Oil (peanut or coconut)	6	—	—	1	—	1	22

TABLE II.—ANALYSIS OF "F" FORCE, THAILAND, CAMP DIETS.
(FIT MEN—WORKERS ON ROAD OR RAILWAY, ETC., I.J.A.).

				June					
				May					
				Usual standard	Konkoita 10-31	Konkoita 1-30	Nieke 7-30	Shimo-Sonkurai 1-30	
					Average	Average	Average	Sick	Workers
Carbohydrate	gram.	..	..	500	433	357	349	329	400
Protein	gram.	..	..	100	33	34	47	39	44
Fat	gram.	..	..	100	2	11	10	12	12
Calories	total	..	..	3,400	1,932	1,703	1,720	1,623	1,935
Calories	non-fat	..	..	—	1,911	1,603	1,627	1,516	1,828
<i>Vitamins</i>									
"A"	in inter-units	..	..	3,000	3	—	20	24	24
"C"	in mgm.	..	..	30	1	3	5.6	4	4
Thiamin (B1)	in micrograms (Y)	..	..	990	272	261	345	275	319
Riboflavin	in micrograms	..	..	uncert. 1-2	0.5	0.8	0.6	0.8	0.9
Nicotinic acid	in mgm.	..	..	uncert. 20	4.8	5.0	4.6	5.3	6.1
Thiamin.	Non-fat calorie ratio	..	..	more than .3	0.14	0.16	0.21	0.18	0.17
<i>July</i>									
				Konkoita 1-31	Nieke 1-31	Shimo-Sonkurai 1-31		Sonkurai 6-31	
				Average	Average	Sick	Convuls.	Camp Dis.	Workers
Carbohydrate	gram.	..	..	492	528	341	454	478	499
Protein	gram.	..	..	42	58	45	53	55	57
Fat	gram.	..	..	9	8	11	11	11	11
Calories	total	..	..	2,275	2,480	1,687	2,186	2,293	2,388
Calories	non-fat	..	..	1,993	2,405	1,586	2,083	2,189	2,284
<i>Vitamins</i>									
"A"	in inter-units	..	..	1,611	54	24	24	24	24
"C"	in mgm.	..	..	19	19	3	3	3	3
Thiamin (B1)	in micrograms (Y)	..	..	383	469	281	352	367	379
Riboflavin	in micrograms	..	..	0.9	0.8	0.7	0.8	0.8	0.9
Nicotinic acid	in mgm.	..	..	5.6	6.3	4.9	6.1	6.4	6.7
Thiamin.	Non-fat calorie ratio	..	..	0.17	0.20	0.18	0.17	0.17	0.17

[continued on p. 162]

TABLE II.—Continued

		August						September		
		Konkoita 1-16	Son- kurai 11-31	Kami-Sonkurai 17-31		Tanbaya 4-31	Son- kurai 1-30	Kami- Son- kurai 1-30	Tanbaya 1-30	
		Sick	Workers	Average	Average	Sick	Workers	Average	Average	Average
Carbohydrate	gram.	262	571	—	412	613	554	—	589	551
Protein	gram.	26	48	—	57	71	69	—	81	69
Fat	gram.	10	12	—	8	9	38	—	18	25
Calories	total	1,271	2,668	—	1,995	2,885	2,903	—	2,912	2,771
Calories	non-fat	1,179	2,537	—	1,920	2,801	2,552	—	2,745	2,540
<i>Vitamins</i>										
"A"	in inter-units	1,464	1,464	—	134	134	220	—	182	285
"C"	in mgm.	4	4	—	—	—	21	—	30	48
Thiamin (B1)	in micro-grams (Y)	232	425	—	461	586	598	—	558	721
Riboflavin	in micrograms.	0.7	1.0	—	1.0	1.2	2.1	—	1.4	1.8
Nicotinic acid	in mgm.	3.7	8.0	—	5.5	7.7	10.1	—	8.8	8.8
Thiamin.	Non-fat calorie ratio	0.18	0.17	—	0.24	0.21	0.23	—	0.20	0.28
		October				November		December-March, 1944		
		Konkoita 1-31	Sonkurai 1-31	Kami-Sonkurai 1-31	Tanbaya 1-31	Kami-Sonkurai 1-17	Tanbaya 1-17	Kanburi Host Dec. 17, 1943- 31 Mar., 1944		
		Average	Average	Average	Average	Average	Average	Average		
Carbohydrate	gram.	568	—	665	562	742	603	385		
Protein	gram.	64	—	81	81	67	94	38		
Fat	gram.	18	—	17	22	22	34	29		
Calories	total	2,750	—	3,216	2,848	3,512	3,084	2,001		
Calories	non-fat	2,586	—	3,053	2,639	3,311	2,858	1,721		
<i>Vitamins</i>										
"A"	in inter-units	5,722	—	404	305	283	234	10,000		
"C"	in mgm.	—	—	90	36	70	8	108		
Thiamin (B1)	in micro-grams (Y)	516	—	703	1,148	705	1,746	465		
Riboflavin	in micrograms.	1.1	—	2.0	2.1	2.1	2.1	1.6		
Nicotinic acid	in mgm.	8.4	—	8.5	14.4	8.9	23.5	4.3		
Thiamin.	Non-fat calorie ratio	0.20	—	0.23	0.43	0.21	0.61	0.27		

TABLE III.—SUMMARY OF "F" FORCE DEATHS. BRITISH AND AUSTRALIAN COMBINED.

	<i>Cholera</i>	<i>Dys. and diarr.</i>	<i>Dys. and Beri-beri</i>	<i>Dys. and malaria</i>	<i>Dys. and ulcers</i>	<i>Beri-beri</i>	<i>Beri-beri and malaria</i>	<i>Beri-beri and ulcers</i>	<i>Malaria Fever Unspec.</i>
ay, 1943 ..	158	9	—	1	—	—	—	—	3
ne, 1943 ..	359	26	1	3	1	5	2	—	6
ly, 1943 ..	50	114	2	8	—	19	1	—	21
ug., 1943 ..	60	261	34	19	8	64	10	1	34
pt., 1943 ..	10	137	82	34	26	61	16	20	19
ct., 1943 ..	—	92	91	23	28	63	9	9	12
ov., 1943 ..	—	127	49	10	25	111	3	7	7
ec., 1943 ..	—	53	52	6	10	70	11	17	20
an., 1944 ..	—	9	15	6	1	11	6	3	8
eb., 1944 ..	—	2	3	3	2	9	3	—	—
ar., 1944 ..	—	1	2	1	—	—	1	—	1
pr., 1944 ..	—	1	1	1	—	—	—	—	1
12 months' total	637	832	332	115	101	413	62	57	132

Expressed as percentages of total 21% 27% 11% 4% 3% 13% 2% 2% 4%

	<i>Malaria and ulcers</i>	<i>Ulcers</i>	<i>Diphtheria</i>	<i>Small-pox</i>	<i>Pneumonia</i>	<i>Other diseases</i>	<i>Total</i>	<i>Strength at beginning of period</i>	<i>Death-rate per mille per annum</i>
ay, 1943 ..	—	—	3	—	—	9	183	6,998	314
ne, 1943 ..	—	—	5	1	1	15	425	6,815	748
ly, 1943 ..	—	2	8	2	2	11	240	6,390	451
ug., 1943 ..	—	21	8	1	—	16	537	6,150	1,048
pt., 1943 ..	11	62	2	—	13	13	506	5,613	1,082
ct., 1943 ..	11	36	2	—	6	13	395	5,107	928
ov., 1943 ..	1	37	—	1	3	14	395	4,712	1,006
ec., 1943 ..	3	9	1	2	12	14	280	4,317	778
an., 1944 ..	2	1	—	1	5	8	76	4,037	226
eb., 1944 ..	1	—	—	—	1	2	26	3,961	79
ar., 1944 ..	—	—	—	—	—	6	12	3,935	37
pr., 1944 ..	—	1	—	—	—	7	12	3,923	37
12 months' total	29	169	29	8	43	128	3,087	6,998	441

Expressed as percentages of total 1% 6% 1% — 1% 4% 100%

(c) *Other Deficiency Diseases.*—A feature which puzzled us was the rarity of diseases attributable to deficiency of vitamin B₂ complex. Scrotal dermatitis, stomatitis and glossitis, painful feet and spastic paraplegia, and eye conditions, diseases from which many of the members of "F" Force had suffered whilst in Changi, were practically non-existent in Thailand. A few cases of frank pellagra with the typical skin lesions were reported, and are said to have developed only after the monsoon rains had ceased.

The estimated amounts of riboflavin and nicotinic acid in the diets were below the daily requirements for most months and at most camps, and, indeed, were on much the same level as the amounts in the Changi diet during the prevalence of these diseases, so that it is difficult to explain this striking difference in incidence. It may be that some of the Thailand foodstuffs contain greater amounts of these substances than we have estimated, or perhaps the monsoon rainy weather was not favourable to the development of these diseases. Another possibility suggested to us by Major R. C. Burgess, R.A.M.C., is that

their absence is in some way linked up with the insufficiency of food (rice) intake in relation to the energy output. This suggestion is supported by the observed fact that many men, who at the time of leaving Singapore were suffering from scrotal dermatitis and/or stomatitis and glossitis, recovered completely either on the train journey to Thailand or on the first few days of the march. Fuller knowledge is required before we can solve this puzzle.

Other Diseases.—Although it was impossible for detailed records to be kept, a fair idea can be given of the incidence of various diseases.

Cholera attacked about 1,300 persons with an immediate mortality averaging 50 per cent, but the ultimate mortality may have been 80 to 90 per cent. Few of the cholera convalescents made a complete recovery, and many of them succumbed later to other diseases.

Malaria attacked about 80 per cent; there were a few cases of blackwater fever.

Dysentery and *diarrhœa* were widespread throughout.

Lung diseases such as bronchitis and pneumonia were surprisingly rare considering the working and living conditions.

Scabies, *lice* and *bugs* affected everyone. These pests were responsible for much loss of sleep, and infected scratches were frequently the starting points of septic sores and ulcers.

General physique: A progressive deterioration in general physique occurred as the months went by. Noticeable enough at the time, it became very obvious when one was able to compare the returned men of "F" Force with the men who had never left Changi. Two months after they had returned to Changi, 1,420 Australians (exclusive of those in hospital) were examined by *Japanese* M.O.s, who classified only 125 of them as being fit for heavy duty.

One must conclude that only an insignificant fraction of "F" Force remained free from disease while in Thailand; the great majority suffered from several diseases, either in conjunction or in succession.

Deaths and death-rates.—6,998 men left Singapore for Thailand in the second half of April, 1943. 3,087 died in the ensuing twelve months, May, 1943, to April, 1944, giving a crude death-rate of 441 per thousand per annum.

SUMMING UP.

We believe that we have reviewed all the main factors which helped to build up the appalling sickness and death-rates of "F" Force.

The situation of the camps made it certain that malaria would be prevalent: the insanitary conditions made it certain that disease, particularly intestinal disease, would be widespread; the previously impaired state of health, the lack of drugs, dressings, and accessories, the lack of medical comforts, and the lowered morale, all made such disease more deadly than normal. But in our opinion—and we think it is shared by every M.O. on this expedition—the gross inadequacy of the Thailand diets, the shortcomings both in the amount of food and in the types of foodstuff, in conjunction with the merciless compulsion to excessive exertion, outweighed in importance all other causes of death.

REPORT ON RATIONS (Written July, 1943).

Diet.—(1) Major Dobson, R.A.S.C., has supplied figures for the rations actually received for the sixteen-day period July 6 to 21, 1943. Analysis of these figures is complicated by the allocation of different amounts to separate groups, such as working parties, camp duty men, and the sick, but the main difference is in the amount of rice supplied to each group. Assuming that such items as onions, beans, potatoes, whitebait, dried meat, and oil, were divided equally, I estimate that these supply only 340 calories per man per day.

(2) The remainder of the energy requirements have to be made up from the rice issue, and rice provides approximately 360 calories per 100 gm. dry weight. Sick men receive roughly 300 gm. rice per day, so that their diet only gives about 1,420 calories. This is below the amount needed for basal metabolism and maintenance of body-weight even in health, and quite inadequate to help a patient through an attack of disease, or to enable him to recuperate afterwards. In other words, once a man goes sick he either dies of disease or is gradually starved to death, and I consider that the present very high death-rate, in the absence of acute epidemic disease, must be largely a result of this very poor diet.

(3) The energy values for the camp duty men, assuming 600 gm. rice, is 2,500 calories, and for working parties, assuming 700 gm. rice and 100 gm. dried fish, is 3,000 calories. These figures are better, though still well below normal requirements for the type of work done, but the diet of all groups is seriously lacking in vitamins, particularly those of the B-complex. Beri-beri is already prevalent and interesting. The diet is also lacking in fat and protein.

(4) I consider it essential that the ration for sick and convalescents should be increased to at least 400 gm. rice per day, and that, as elsewhere, rice polishings, more towgay, peanuts, potatoes, green leaf vegetables and fats, should be provided for everyone to make good the existing deficiencies. There is sufficient wild pumpkin leaf growing in the isolation area to supply certainly the sick, and probably most of the camp, with green leaf vegetables for quite a long time. These leaves have been pointed out to several people, including officers.

Table showing analysis of the diet, assuming equal distribution of food among the camp strength of 1,320 men.

	<i>Amount</i>		<i>Carbohydrate</i>		<i>Protein</i>		<i>Fat</i>		<i>Total</i>	<i>Non-fat</i>
<i>Article</i>	<i>in</i> <i>gram.</i>	<i>gram.</i>	<i>Calories</i>	<i>gram.</i>	<i>Calories</i>	<i>gram.</i>	<i>Cals.</i>	<i>cals.</i>	<i>cals.</i>	
Rice ..	450	361	1,444	27	108	2	18	1,570	1,552	
Beans ..	42	21	84	8	32	—	—	116	116	
Onions ..	112	17	68	1	4	—	—	72	72	
Dried Meat	16	—	—	6	24	7	63	87	24	
Whitebait	9	—	—	6	24	—	—	24	24	
Potatoes ..	10	2	8	—	—	—	—	8	8	
Oil ..	3	—	—	—	—	3	27	27	—	
Total	642	401	1,604	48	192	12	108	1,904	1,796	

Thiamin—380Y (115 International Units) vitamin B₁.

Thiamin-non-fat-calorie ratio — .212.

AN APPRECIATION OF SMALLPOX AS IT AFFECTS THE HYGIENE SERVICES OF THE BRITISH ARMY TO-DAY.

BY

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INTRODUCTION.

Smallpox is a rare disease in this country to-day and is usually mild. The Chief Medical Officer to the Ministry of Health, in his report on the State of the Public Health during six years of war (1939 to 1944), gives the following figures: a total of 27 notifications was received and in six instances the diagnosis was not confirmed. Only three deaths occurred, all in 1944. Two epidemics of major smallpox, which attracted much attention, occurred in Scotland in 1942, the one in Glasgow, the other in Edinburgh, but the total number of cases did not exceed 72 (Clark, 1944; MacGregor and Peters, 1942).

The last great epidemic of variola major in England was in 1901-1902. In 1922 the country was invaded by variola minor, cases of which appeared for a number of years afterwards. After 1922 there were two distinct types of smallpox in Great Britain, the American type, variola minor or alastrim, and the North African type, variola major or classical smallpox. Until a few years ago, variola minor smouldered endemically and occurred widely over the country: outbreaks of variola major have been due to infection brought from overseas. Maddock and Conybeare (1946) investigated 55 cases of variola major which occurred in England between January and June, 1946. Fifteen of these were infected in India, or on the voyage from India; the remaining 40 were infected in England, and, though a direct connexion with an imported case could be established in only 7 of these, the other 33 were grouped into ten separate outbreaks, all of which occurred in districts, and at times, which suggested indirect association with cases known to have been shipborne.

In addition to the lessened mortality from the disease brought about by the replacement of variola major by variola minor, there was evidence that variola major itself was declining in fatality: in 1871 the case fatality rate of patients treated in the London smallpox hospitals was 45 per cent, in the 1902 epidemic 17 per cent. The case fatality rate of 13,686 patients admitted to L.C.C. hospitals in the period 1928-1934 was a quarter of one per cent (Marsden, 1936).

As a result of the mild nature of the disease and of its infrequent occurrence, together with the active propaganda of the anti-vaccinationists, the British public has largely neglected vaccination, and to-day less than 40 per cent of infants are vaccinated.

But, of the so-called "convention diseases," only smallpox seriously worries

the Public Health Authorities because of the danger of its introduction into this country from abroad and of its subsequent rapid spread amongst the largely susceptible population. Several small outbreaks have in fact occurred, during the last year or two, where the infection had been brought from overseas by Service personnel.

The general public has not been alarmed by these small outbreaks and, despite the increased risks introduced by the spread of air travel, the Ministry of Health has been satisfied that the vigilance of the Public Health Service, in detecting cases of smallpox and tracing contacts, is sufficiently to be relied upon to control the disease. Indeed, some authorities, such as Killick Millard (1946), have taught that mass vaccination is an inefficient method for eradicating smallpox from a community, and that control by the ordinary methods of segregation, surveillance and disinfection is enough.

Therefore, vaccination which has hitherto been considered the chief method of protection against smallpox, and which has been compulsory since 1853, has been put upon a voluntary basis by the National Health Services Act 1946.

In view of this change in the attitude of the civil authority, it is appropriate to examine the question of how smallpox may affect the efficiency of the Army and the measures necessary to prevent its occurrence.

HISTORICAL.

"An outbreak of smallpox in the regular Army prior to the commencement of the war (1914-1919) was not viewed with alarm owing to the protection afforded by the increasing attention paid to the vaccination of personnel and to the disposal of smallpox cases and contacts. Every recruit was vaccinated on enlistment, and any man presenting himself for enlistment who refused to be vaccinated was not accepted." (Official History of the War—Medical Services—Hygiene of the War, Vol. II, Chap. XVI.)

The happy state of affairs outlined above must be the envy of any hygiene officer who is responsible for the protection of troops from smallpox to-day. It was a system which had proved its worth: the British Army has never had such a disastrous epidemic of smallpox as the French in the campaign of 1870-71, when 125,000 French soldiers contracted smallpox, of whom 23,470 died.

In January, 1916, an Army Council Instruction was published authorizing the enlistment of men, even though they declined to be vaccinated. This opened a breach in the wall of protection built by the Army Medical Services against smallpox, a wall now in danger of being brought down altogether by the National Health Services Act of 1946.

In most theatres of war in 1914-1919 smallpox did not present a very serious problem, but in Mesopotamia, where Baghdad is one of the endemic homes of smallpox, a big outbreak occurred. The total number of cases from December, 1916, to October, 1919, was 1,908: great difficulty was experienced in eradicating the disease, as vaccination was no longer compulsory. The administrative difficulties caused by the occurrence of so many cases of such an infectious and mortal disease, and the drag thus put upon an army in the field, are easy to appreciate.

Another outbreak will be mentioned, not so serious, but, occurring when and where it did, of great importance. The extract is from the Official History of the War (1914-1918), *Military Operations—Gallipoli*, Vol. I, p. 147. "Final preparations at Mudros. . . . Among the minor mishaps at this time was the discovery on the 20th April that one of the Commander-in-Chief's clerks had contracted smallpox, with the result that everybody on board the headquarters ship 'Arcadian' had to be hurriedly vaccinated next morning—a curiously unfortunate time for so fretful a proceeding. . . . In some cases the vaccination 'took' very severely and the two senior officers carried their arms in slings for the next three weeks." Surely it was an unfortunate time; the attack on the beaches took place five days later. Sympathy must be felt for the medical officer who had to enforce vaccination upon such an assembly, at such a time.

In the last war smallpox was perhaps less of a problem. There was again a small outbreak in Baghdad, but S.E.A.C. was the theatre in which smallpox was most prevalent; in 1943 the months of July and August produced approximately 460 severe cases of smallpox from an army of about 400,000. In 1944 the same months showed 160 and 200 cases of smallpox in a force of approximately 700,000. Severe cases predominated. "It is plain from the numbers that contracted smallpox in the East shortly after arrival from Europe that neither those at risk, nor those advising them and giving them medical care, were convinced that the repeated warnings of the Army Medical Department were justified" (D.D. Hygiene, A.L.F.S.E.A.).

It was from South-East Asia and India that returning Servicemen introduced *variola major* into this country in 1946.

From July to December, 1946, *variola major* was epidemic amongst the inhabitants of Tripoli (N. Africa). Seven hundred and seventeen civilian cases occurred, with 107 deaths. Only 4 cases occurred in British soldiers, but the importance of the epidemic can be appreciated when it is realized that a main airfield, from which large numbers of passengers were daily travelling to the U.K., was situated on the outskirts of the town.

Enough has been written to show the importance of smallpox as a danger to armies, both as a disease which is capable of producing many casualties with a high mortality rate, and as a threat which has continually to be fought off by the Medical Services, at the price of elaborate administrative arrangements.

We must now consider its geographical distribution in relation to overseas Garrisons.

GEOGRAPHICAL DISTRIBUTION.

India and Egypt are the great endemic foci of *variola major* for Asia and Africa respectively. Both are still important stations for British troops and their families.

In 1938, 82,640 cases of smallpox, with a mortality of 27 per cent. were reported amongst the civil population of British India. In the Report on the Health of the Army, the following figures are given: 7 cases of smallpox occurred in 1936 in a military population of approximately 65,000 men, women and children. In 1935 only 8 cases occurred. The figures for previous years

are much the same and provide strong evidence in favour of the protective measures adopted, the principal of which is vaccination; vaccination levels for the Army in India during the years referred to were 98 to 99 per cent. Nevertheless, the figures quoted above for smallpox in the civil population emphasize the risk run by those who serve in India.

In 1938, severe outbreaks occurred in Nigeria and China; later outbreaks in Iraq, Tripoli and S.E.A.C. have already been mentioned. Epidemics are frequent in West Africa. In all these places there are British Garrisons.

No further purpose is served by describing in detail the geographical distribution of smallpox. It is sufficient to sum up by saying that wherever the British soldier is likely to serve abroad, there he will be exposed to the risk of contracting smallpox.

PRESENT STATE OF THE SERVICE.

Conditions in the Army are still unsettled and range from a state of war in Palestine to a garrison life in places such as Gibraltar where the standards approach those of pre-war days. The final military commitments and permanent overseas stations of the Army are undecided and many delicate tasks, notably the withdrawal from India, remain to be done.

In the midst of this turmoil, an attempt is being made to establish garrisons with all the amenities of civilization. Military families are already overseas and many more are anxious to go. As a result of the war, accommodation and living conditions for these families may be improvised and cannot yet be entirely satisfactory.

The families themselves are inexperienced in travel, in the life of foreign countries and often of the simple rules of health. These are not the families who followed the flag to all the corners of the Empire in the days before the war. And we have seen that in many stations they will be exposed to the danger of smallpox in bazaar and market, from native servants and from tradesmen.

The conscript soldier, too, is young, inexperienced, and, in this immediate post-war period, less disciplined than his pre-war or wartime counterpart. For him also, smallpox lies in wait in bazaar and canteen.

Trooping by sea and air goes on continually; all over the world, at all seasons, on a vast scale, and carrying everywhere the risk of dissemination of smallpox.

It is clear that smallpox presents a danger which the Army Medical Services cannot afford to neglect, and which is ever present.

Let us, therefore, examine the methods of prevention which are in use to-day. But first it is necessary to consider briefly how smallpox is spread.

MODES OF SPREAD.

Smallpox is primarily an infection of the upper respiratory tract and droplet spray the principal method of spread. Dry scabs may remain infectious for long periods and spread by fomites may therefore occur. It is not generally accepted to-day that aerial convection for long distances is an effective mode of spread; cases attributed to aerial convection are more likely to be due to an undetected human vector.

METHODS OF PREVENTION.

(1) *Isolation*.—The first of these is the isolation of the suspected case of smallpox. Two points of importance which arise here are (i) diagnosis, (ii) hospital arrangements.

(i) While the diagnosis of an established case of classical smallpox is easy, the early diagnosis, especially of modified smallpox, which is the type most likely to be met with in soldiers, may be difficult even for experts.

It is, therefore, essential that medical officers should be aware of the importance of the disease and of the main points relied upon in diagnosis. Administrative medical officers should be responsible for seeing that medical officers under their command are given every opportunity of examining, and being taught upon, cases of smallpox. As opportunities may be few, such instructional facilities as cinema films, collections of photographs, and literature on smallpox, should be available in every command, especially overseas.

Instructional establishments, such as the Royal Army Medical College and the various schools of military hygiene, should have permanent displays of data, photographs and exhibits relating to the diagnosis of smallpox. Finally, it should be the duty of every hygiene officer to make sure that all ranks of the Army Medical Services in his area are taught the importance of smallpox, its principal diagnostic features and its prevention.

(ii) The provision of special hospitals for smallpox in an Army is impracticable; that such provision should be made necessary by an outbreak would show the failure of the hygiene services to prevent the disease. It is therefore essential that administrative medical officers and officers commanding hospitals should understand clearly the action they must take, if a case of smallpox occurs, and the hospital arrangements they must make.

The following paragraph which gives recommendations for modern, civil smallpox hospitals is quoted by van Rooyen and Rhodes (1940) from "Sanitary Law and Practice" by Porter and Robinson (1931).

"At the time of an epidemic, temporary accommodation, such as wooden or corrugated iron buildings, should be built to cope with a sudden rush of cases, and each smallpox case should have 3,000 cubic feet of ward space. A smallpox hospital should not be built (i) on a site where it would have within $\frac{1}{4}$ mile of it as a centre either a hospital, whether for infectious disease or not, or a work-house, or any similar establishment, or a population of 150 to 200; (ii) on a site where it would have within $\frac{1}{2}$ mile of it as a centre a population of 500 to 600 persons."

Regulations for the Medical Services of the Army, 1938, Appendix 2, paras. 36 and 37, deal with the preventive measures to be taken in the event of an outbreak of smallpox. The patient must be isolated immediately in (a) a civil smallpox hospital, if one is available; (b) in tents, when no smallpox hospital is available; (c) in huts, or in some isolated building temporarily adapted for the purpose, if tents are undesirable for climatic reasons. Tents should, if possible, be placed to the leeward of habitations at a distance of at least 400 yards. Cases should not be isolated in infectious hospitals containing patients suffering from other diseases.

The regulations state that attendants and nurses should be immediately vaccinated, provided with overalls and segregated. The clothing, bedding and personal belongings of contacts and attendants, and all tents or other quarters used for their accommodation, as well as any vehicles that might have become infected, should also be disinfected.

Except for one omission, the above instructions are adequate, and will be seen to be consonant with modern civil practice: it will never be wrong to take rigid precautions in the isolation and nursing of smallpox cases, in view of the serious and highly infectious nature of the disease and of its social importance. To repair the omission referred to, an instruction should be put in the Regulations that attendants on smallpox patients should wear masks, because the disease begins as an infection of the upper respiratory tract.

Some authorities would not insist on segregation of the attendants in their off-duty hours; but, when attendants are provided for smallpox cases from a general hospital, would allow them to occupy their own quarters and mix with the rest of the staff in their off-duty hours, provided that they had been successfully vaccinated and observed strictly the routine precautions of disinfection and the wearing of cap and gown.

"In the case of variola minor, the precautions may be less stringent, but if variola major is in question, they must by no means be relaxed" (Harries and Mitman, 1947).

(2) *Disinfection*.—The most recent Army procedure is given in an Army Council Instruction published in 1946. Its provisions are as follows:—

(i) *Disinfection of accommodation*. Ventilation of the room occupied by the patient with washing of the floor and other surfaces with soap and hot water will be carried out. Disinfectant need be added to the soap and water only in cases of SMALLPOX, cholera, pneumonic plague, pulmonary tuberculosis and typhus.

(ii) *Personal clothing and bedding*.

(a) In all cases of infectious disease clothing and bedding will be laundered.

If this is carried out effectively by the method in use in the Army, no further disinfection will be necessary except as directed in subparas. (b) and (c) below.

(b) Disinfection will be carried out after cases of the following diseases—SMALLPOX, etc.

(c) Disinfection will also be carried out if it is not possible to launder the bedding and clothing of an infectious case, or when such a procedure is insisted upon before acceptance by a public laundry.

(iii) *Bedding and clothing of contacts*. Disinfection will not usually be carried out.

Such are the most recent provisions for disinfection in the Army.

The most usual disinfectant to be added to the soap and water is 2½ per cent cresol (Regs. for Medical Service of Army, 1938); articles of clothing and bedding must be soaked in 2½ per cent cresol and packed in sacks or sheets which have similarly been soaked, before being sent to laundry or disinfector.

Articles, such as leather goods and books, which cannot be disinfected by

steam, and textiles which may be injured by cresol, should be sprayed with formaldehyde. Items of little value should be burnt.

The modern knowledge upon which the above procedure is based is summarized by McCulloch (1945).

"White cottons and linens are washed in alkaline, soapy waters at temperatures up to 140°F to 160°F., are subjected to a chlorine bleach at this temperature and are usually rinsed at 160°F. Only sporulating organisms could survive this treatment.

"Silks, rayons and woollens must be more carefully handled. These are washed in solutions of very mild alkalies and soaps at temperatures of 90°F. to 100°F. with little or no bleach being used. The soap solution would kill pneumococci and most strains of streptococci. This treatment is not sufficient to kill occasional pathogens if the clothing has been subjected to heavy contamination.

"Formaldehyde fumigation is now known to be of little value and the author believes that formaldehyde solutions have a very limited application as germicides.

"Sulphur dioxide at one time was considered as an active germicide, though it is now only used for sulphuring fruit and wine casks, and as a fumigant against insects and vermin.

"The filterable viruses are very susceptible to the action of the alkalies. They are very resistant to ultra-violet light and desiccation and resistant to phenol, but the emulsified coal tar disinfectants are more effective."

The mechanical cleansing action of soap and water, the effect of the alkali and of the disinfectant, as measures of terminal disinfection, should be sufficient to destroy the virus of smallpox in the accommodation occupied by the patient.

For clothing and bedding, laundering is effective for the common infectious diseases, but is not sufficient for all types of material in cases of smallpox, particularly as in this disease the virus may be contained in shed scabs.

Occasional pathogens will escape when woollen articles are being laundered, if the articles have been subjected to heavy contamination; this is the case in smallpox, where Paschen bodies occur in great numbers in the skin lesions, and where, as a result, patients' bedclothing becomes heavily infected. Therefore, disinfection by steam under pressure must be carried out.

In view of the questionable value of formaldehyde solutions as germicides, leather goods and books should be destroyed, whenever possible.

Aerosols are not regarded as of any special value in smallpox disinfection.

It is important to remember that smallpox is primarily an infection of the upper respiratory tract and that the method of spread in the early stages is by droplet spray. Therefore, patients' feeding utensils, which are liable to become infected and to remain so, as the Paschen bodies are not easily killed by drying, must be concurrently disinfected. This may be effected by steam, boiling or by soaking for thirty minutes in 2½ per cent cresol, followed by washing in hot water containing soda.

Summary.—The spread of smallpox is by droplet spray and by fomites. Rooms and motor ambulances used by the patient must be disinfected ter-

minally by soap, hot water and $2\frac{1}{2}$ per cent cresol; bedding and clothing concurrently and terminally by steam under pressure; feeding utensils concurrently and terminally by boiling, steam or cresol; leather articles and books terminally by formaldehyde or, better, by destruction.

In smallpox, above all diseases, careful attention must be given to the details of concurrent and terminal disinfection.

(3) *Contacts*.—The official Army policy laid down in Regulations for the Medical Services of the Army 1938 is that contacts should be immediately segregated, revaccinated and examined daily. They should be segregated for eighteen days unless successful vaccination proves that they are protected from the disease. On the occurrence of a case in barracks or its vicinity, troops and their families should be examined, and revaccinated, where this has not been done within two years. In the presence of an outbreak all persons suffering from fever should be isolated for four days and special search made for any eruptions on them of a papular or vesicular character; the occurrence of such eruptions should call for the most careful investigation at all times. The clothing, bedding and personal belongings of contacts should be disinfected. All troops and families arriving from infected areas should be treated as contacts.

In some respects the above precautions are stricter than those current to-day. The Ministry of Health Memorandum on Smallpox 1938 advises that vaccination or revaccination should be offered to all contacts and that they should be kept under medical surveillance for a period of sixteen days after the last exposure to infection. For this purpose it is seldom desirable or necessary to isolate them in their houses.

During the war, and immediately afterwards, when smallpox cases in returning Servicemen gave rise to several outbreaks of the disease, the period of surveillance by both civil and military hygiene officers was fourteen clear days from date of disembarkation, in accordance with Port Sanitary Regulations 1933, which are based upon the International Sanitary Convention held at Paris in 1926. The incubation period of smallpox remains remarkably constant at twelve days, but for the purposes of the International Sanitary Convention 1944, the period of incubation is reckoned as fourteen days.

Again, present practice regarding the disinfection of clothing and bedding of contacts is not so rigid. In the Army Council Instruction on Disinfection, which has already been quoted, it is stated that such disinfection will not normally be carried out.

The decision to disinfect the personal belongings of contacts should be based, therefore, upon the certain knowledge that these belongings have been infected. It follows that only the effects of "close" contacts should be disinfected and that the decision should be made in each case on its merits. "Close" contacts are those who live in an intimate family relationship, i.e. husband, wife and children, where members of the family may share the same bed. In the case of soldiers "close contact" is most likely to occur in tents and bivouacs under field service conditions; in peacetime barrack life the infection of the belongings of contact will hardly occur.

A most important sentence in the Army Regulations is that dealing with

the search for any eruptions of a popular or vesicular character on persons suffering from fever in the presence of an outbreak of smallpox. The significance of this will be shown later when outbreaks of smallpox caused by Servicemen returning from abroad are being considered.

It is interesting to note, with regard to the instruction that revaccination should be performed in the presence of an outbreak upon those who have not been revaccinated within two years, that during the last war this period was reduced to one year in S.E. Asia because of the prevalence of smallpox (D.D. Hygiene A.L.F.S.E.A. 1947).

(4) *Notification.*—Isolation of patients, following upon notification, is not in itself enough to stop an outbreak of smallpox from spreading, because cases are infectious before the diagnosis is made clear by the appearance of the rash, and because some cases may be missed.

The importance of notification to medical administrative officers is that it enables such measures as vaccination to be taken quickly to limit the spread of smallpox, and arrangements to be made in hospitals for the treatment of further cases. Therefore, notification must be prompt and should include suspected cases. In the "Remark" column of the notification form, details of the patient, such as his vaccination history and recent movements, which are of value in planning preventive measures, should be given. It may be desirable to make chicken-pox temporarily notifiable during an epidemic of smallpox; such a contingency may arise in a big garrison town. Chicken-pox was permanently notifiable in Malaya before the war.

It is necessary to remember that smallpox must be notified to the civil authorities by law and that medical officers of health themselves, by the Sanitary Officers (outside London) Regulations 1935 and the Sanitary Officers (London) Order 1926, must notify immediately any case of smallpox to the Minister of Health, preferably by telegram.

The immediate notification of military cases of smallpox to the civil authorities should be only part of a close co-operation to limit the spread of the disease: exchange of information between Military Medical Embarkation Staffs and Port Health Authorities, between the Army Medical Department and the Ministry of Health, must be continual, so that administrative action may be prompt and well integrated.

(5) *Trooping by Sea and Air; Control of Smallpox.*—Troop movements by sea and air are, perhaps, the most important means of spreading smallpox at the present time, and several small outbreaks have been caused in this way since the end of the war. The subject is one of the greatest importance and needs careful examination.

The control of smallpox by international agreement will first be considered.

Before the last war, two International Sanitary Conventions were of importance in the control of the five major "convention diseases", of which smallpox is one. These were (i) The International Sanitary Convention, Paris, 1926, the provisions of which were put into effect in England and Wales by the Port Sanitary Regulations, 1933, and (ii) The International Sanitary Convention for Aerial Navigation, 1933, of which the Public Health (Aircraft) Regulations, 1938, are the expression in this country.

The chief provisions of the International Sanitary Convention, 1926, were:—

(i) Exchange of information relating to outbreaks of the five "Convention Diseases" amongst the signatories.

(ii) Arrangements for "observation" (quarantine in detention), and "surveillance" (liberty under supervision), of travellers, and for detention and disinfection of ships. Unnecessary interference with passengers, merchandise or mail to be avoided.

(iii) Regulations for the sanitary control of the Mecca pilgrimage.

Port Sanitary Regulations, 1933, implemented the provisions of this convention in England and Wales. A summary of that part of the regulations which relates to smallpox is as follows: it applies to ships which, during the voyage, or, if the voyage has lasted more than six weeks, within the last six weeks, have had, or at the time of their arrival have, a case of smallpox on board.

"The ship shall be inspected and all persons on board shall be medically examined. The sick shall be immediately disembarked and isolated. Contacts shall be offered vaccination, unless sufficiently protected by recent vaccination or by a previous attack of smallpox. Every such person shall be placed under surveillance for a period not exceeding fourteen days after the date of arrival of the ship. Bedding which has been used, soiled linen, and any other article which the medical officer considers to have been recently infected, shall be disinfected. Direct contacts may be placed under surveillance for a period not exceeding fourteen days after landing.

"Persons not vaccinated will have their names notified to the Medical Officer of Health of the district to which they are proceeding, so that surveillance may be carried out for fourteen days."

Article 42 of the International Sanitary Convention, 1926, states that: "It rests with each Government to take, after disembarkation, the measures which they consider appropriate to ensure the surveillance of persons who are not protected by vaccination, and who arrive on a ship which has had no case of smallpox on board, but who have left a local area, where smallpox is endemic, within the previous fourteen days."

Article 35 of the International Sanitary Convention for Aerial Navigation reads as follows:—

"(a) If there has been no smallpox on board, no sanitary measures may be carried out save in the case of persons who have within fourteen days left a local area where smallpox is epidemic and who are, in the opinion of the sanitary authority, insufficiently immunized. Such persons may be vaccinated, or subjected to surveillance, or to vaccination followed by surveillance, the period of which shall not exceed fourteen days from the date of arrival of the aircraft.

(b) Measures applicable if there is a case of smallpox on board.

(i) Medical inspection.

(ii) The sick must immediately be disembarked and isolated.

(iii) Others who have been exposed to infection and who, in the opinion of the sanitary authority, are not sufficiently immunized, may be subjected to the measures detailed in para. (a).

(iv) Linen, personal effects and other articles, which the sanitary authority considers to have been recently infected, shall be disinfected.

For the purposes of this article, persons shall be considered immune if they:—

(a) Can prove that they have had a previous attack, or, if they have been vaccinated within three years and more than twelve days ago, or

(b) If they show local signs of an early reaction attesting immunity.”

Article 52 reads: “Persons who arrive in Aircraft in any territory of a High Contracting Party, and who have been exposed to the risk of infection by one of the diseases (includes Smallpox) in Article 18, and who are within the period of incubation, may be subjected to surveillance until the end of that period.”

During the late war, as the Office Internationale d'Hygiene Publique was in enemy hands, the Standing Technical Committee of Health of U.N.R.R.A. revised the Sanitary Conventions of 1926 and 1923, the result being expressed in the provisions of the International Sanitary Conventions 1944 (the International Sanitary Convention 1944 and the Int. San. Con. for Aerial Navigation 1944). Yellow fever was the disease principally dealt with, but new definitions of smallpox and recent vaccination were made and the Articles dealing with smallpox were strengthened. “Recent vaccination” now means evidence of successful vaccination not more than three years or less than fourteen days previously, or evidence of an immune reaction. Contacts who, in the opinion of the sanitary authority, are not sufficiently protected by recent vaccination, or by a previous attack of smallpox, may now be subjected to observation, i.e. the isolation of persons, whether on board ship, or at a sanitary station, before they obtain free pratique. And instead of Medical Officers of Health being required to search for a person placed under surveillance, the responsibility can be placed upon the person to report to the Medical Officer of Health.

Governments are urged to adopt the international forms for certificates of vaccination as appended to the new Conventions.

For aerial navigation the old system of sanitary documents is abolished. The commander of an arriving aircraft must present an “Aircraft Declaration of Health” and passengers must make a personal declaration of origin and health on a form known in this country as “Health Form 2” which requires, in addition to place of origin, a record of each place where the passenger has stayed during the preceding fourteen nights.

Passengers arriving in this country by air from suspected areas are given a card warning them to report at once to a doctor any symptoms of illness, and to notify any change of address to the Medical Officer of Health of their destination. The Public Health Authority of the Airport notifies the Medical Officer of Health that certain passengers, contacts of smallpox or from suspected areas, are travelling to his district, so that the appropriate surveillance may be carried out.

The new World Health Organisation will be the International Body administering the Conventions.

The Medical Intelligence Department of the Ministry of Health distributes the “Weekly Record of Infectious Diseases at Ports,” which is prepared in accordance with the Paris Convention of 1926, and which deals with the five “Conven-

tion Diseases." The essential information from this record is distributed to the Medical Departments of the Fighting Services.

During the last war, because of the number of smallpox cases entering the country, a Defence Regulation was made that anyone who refused to be vaccinated on arrival, or who gave an unsatisfactory address, could, on a Magistrate's Order, be kept in isolation for the period of surveillance.

A survey of sea and air trooping during the war will be begun by a brief mention of two small outbreaks in 1946, which were typical of several others at the same time, the infection being introduced from abroad by returning Service personnel.

Both outbreaks began in January, 1946. The details of the first are as follows:—

A troopship arrived at a U.K. port on January 14, 1946, with a case of smallpox on board, which had developed during the voyage from Bombay. A lance-corporal, who had worked in the troopship hospital, was released from the Army after this voyage. On February 12 his nephew went into hospital with mild smallpox and a second nephew began a mild attack on February 22. The sanitary inspector, who removed the bedding and clothing from the second case for disinfection, was an anti-vaccinationist although he had once been vaccinated in infancy. He died of hæmorrhagic smallpox; his wife, too, developed smallpox but recovered. In all, 16 cases occurred in the area, with 4 deaths. The soldier, who was the cause of the outbreak, was found on February 12 to have three ill-developed pustules on his back and a small pustule upon one wrist. He had four scars of vaccination in infancy and one mark of revaccination in 1941.

The second outbreak began with an R.A.M.C. Major who arrived in the U.K. by air from Poona on January 15, 1946. Three days later he had a brief illness, thought at first to be influenza, but a slight rash was later discovered and smallpox diagnosed. On February 4, his wife and daughter were taken ill, and on February 9 the diagnosis of smallpox was made.

These two cases are typical of the way in which classical smallpox is likely to be introduced into this country, and bring out the fact that it is the modified case, or the case which is missed because of a scanty eruption, which is the danger. The importance of educating medical officers to be on the watch for cases of modified smallpox will be stressed again; it is only by their vigilance that such outbreaks as those outlined above can be prevented.

Towards the end of the war, and in the year afterwards, much anxiety was being caused to the Public Health Authorities by the number of cases of smallpox developing on troopships returning to this country from the East. Close liaison between the Medical Department at the War Office, the Ministry of Health, and Overseas Commands, in preventive measures, was so successful that, by the end of August, 1946, the Director of Hygiene at the War Office was able to say that the success of the preventive measures taken had been well demonstrated by the cessation of arrival of ships infected with smallpox. Service personnel have not been sources of infection in the outbreaks occurring in early 1947.

Typical cases of smallpox occurring on troopships are given below.

(i) H.M.T. — ex Bombay. Arrived Suez with one case of smallpox on board. The case was disembarked at Suez and taken to hospital. Five close contacts were also disembarked. The affected troop decks and contacts' kit and bedding were disinfected. The entire ship's complement was vaccinated on the day the diagnosis was made, except for one conscientious objector. He was disembarked at Suez. H.M.T. — then sailed for the U.K.

(ii) H.M.T. — ex India. On April 26, 1946, a case of smallpox was taken off at Suez. On diagnosis of the disease, a medical inspection and vaccination of the ship's complement had been carried out. The messdeck and standees were disinfected with cresol and close contacts were quarantined. On arrival at Suez, the patient, close contacts, and one conscientious objector to vaccination were disembarked. The messdeck, hospital wards and isolation hospital were disinfected with formalin, and all bedding from infected areas was taken ashore for disinfection.

A draft of 500 men for the U.K. was to be taken aboard at Port Said. Only those who could show definite proof of successful vaccination within two years were taken, and these men were revaccinated aboard. 253 men were refused embarkation because their vaccination state was unsatisfactory.

As an example of preventive measures taken in the East before Service personnel were embarked for home, the practice adopted in India will be quoted. Only those who could prove successful vaccination, or revaccination within two years, were embarked. Objectors were quarantined for fourteen days before embarkation, and Port Health Authorities took special measures to deal with the possibility of the introduction of infection by casual dock workers, and to improve the vaccination state of ship's crews.

The complications introduced by the increased use of air travel may be illustrated by consideration of the outbreak of smallpox in Tripoli (North Africa) during the latter half of 1946. Castel Benito Airfield on the outskirts of Tripoli was used extensively by passengers for the U.K. All personnel flying from Tripoli to the U.K. were subjected to surveillance for fourteen days after leaving. The Medical Officers of Health of their destinations were warned that they were possible smallpox cases and all travellers were warned to report any symptoms of illness at once to a doctor.

Another example of the measures taken to prevent spread of smallpox by air travel was the transmission of Medical Intelligence through Service channels. Such was the signal sent home by H.Q. Air Command S.E.A.C. to the effect that, because of the prevalence of smallpox in Rangoon, all passengers proceeding by air to, or through, Rangoon, should be in possession of written evidence of successful vaccination against smallpox within one year and not less than fourteen days.

All these examples show, not only the severity of the measures taken by the Army to prevent the spread of smallpox from abroad to the civilian population in this country, but also the difficulties, the elaborate administrative arrangements which have to be made, and the disruption of the smooth working of the Army machine when smallpox cases occur.

The following principles of prevention of smallpox in Trooping by Sea and Air emerge:—

A. *Before Embarkation*.—(i) Successful recent vaccination. Not less than

fourteen days and not more than two years may be taken as the period of recent vaccination in the Army; fourteen days and three years is the period given by Article XIII of the International Sanitary Convention 1944.

(ii) Quarantine of conscientious objectors to vaccination for fourteen days before embarkation from an infected area. This is in accordance with Article VII of the Convention of 1944.

(iii) Notification by Medical Intelligence of Areas and Ports where smallpox prevails, so that (i) and (ii) may be imposed where necessary.

B. *Aboard Ship*.—(i) The isolation of the case and its disembarkation as soon as possible to a smallpox hospital.

(ii) The isolation and disembarkation of close contacts. This is in accordance with the provision of the Convention of 1944 that contacts may be subjected to observation (isolation, whether on board ship, or at a sanitary station, before obtaining free pratique).

(iii) Medical inspection of ship's complement, as soon as a case is suspected.

(iv) Revaccination of all aboard.

(v) Quarantine for fourteen days of objectors to vaccination, and disembarkation, if possible.

(vi) Disinfection of mess decks, affected troop decks, clothing, bedding, etc.

(vii) Despatch of information to port of disembarkation by wireless, or other means, that there is a case of smallpox aboard.

C. *On Disembarkation*.—(i) All passengers to be regarded as contacts and any revaccination needed to be done.

(ii) Medical Officers of Health of the districts to which passengers are going, and Medical Officers of Service Establishments, to be notified so that surveillance, for fourteen days from the date of disembarkation, may be carried out.

(iii) All passengers to be given cards on which to report any change of address within fourteen days of disembarkation and giving warning to report at once any symptoms of illness to a doctor.

"Even the most careful attention to the provisions of the Port Sanitary Regulations, including conscientious surveillance of crew and passengers after arrival in this country, leaves loopholes for the entry of smallpox. Therefore adequate vaccination of all who travel from infected places is the only true safeguard" (Macgregor and Peters, 1942). With this quotation, we can now pass on to a survey of vaccination.

(6) *Vaccination*.—It is impossible to discuss, within the limits of this paper, the arguments for and against vaccination. Those in favour of vaccination are still strong enough to convince everyone, except the most obstinate or the most prejudiced. But during the war years, although it is generally realized that vaccination will not guarantee 100 per cent protection, some anxiety has been caused by the number of cases of smallpox which have arisen in persons comparatively recently vaccinated.

Until 1946, British Army procedure was based upon the classification of Leake (1927) and upon that of the League of Nations Sub-committee on Vaccination (1928) into primary, immune, and accelerated reactions. Marsden (1946) states that much of the confusion of recent years in regard to smallpox

in the vaccinated had its origin in the immediate (immune) reaction. "While it is probably true that an immediate reaction is the normal response to vaccination of the completely immune individual, the evidence that this reaction can occur in a subject who is susceptible to vaccinia, or to smallpox, is overwhelming." He prefers the classification into (i) successful vaccinations (which proceed to vesiculation), and (ii) unsuccessful vaccinations (all others).

The writer, from his experience of the revaccination of troops, is convinced that this simpler classification should be adopted, as, indeed, it has been adopted by the Army. The difficulties of interpretation when Leake's classification is used, and the practical difficulties experienced in getting troops for more than one examination of results, make a simple criterion of success, with the minimum number of attendances on the part of the vaccinated, essential.

When the criterion of vesiculation is adopted as the only indication of successful vaccination, reports such as that of Illingworth and Oliver (1944), who recorded that among 96 smallpox patients 70 had been vaccinated successfully within the two years previous to the attack, appear in a new light, for these observers included, among the successfully vaccinated, patients who showed an immune reaction.

Army practice has recently been changed by an Army Council Instruction of 1946, and brought into line with that advocated by Marsden. This instruction emphasizes the fact that vaccination is voluntary, though every effort should be made to instruct and persuade.

The new procedure is as follows:—

(i) All recruits are vaccinated on enlistment (except conscientious objectors). The result is noted in seven days, and is regarded as successful if vesiculation is present. If there is no vesicle, the recruit is revaccinated, and the result read in seven days. If again there is no vesiculation, the result is recorded as I.T.V. (insusceptible to vaccination). Men recorded as I.T.V. are revaccinated, while in the Service, at the usual intervals.

(ii) Revaccination.—(a) At home and in N.W. Europe. Every five years.
(b) Elsewhere overseas. Every two years.

All troops and families proceeding overseas should be vaccinated (on a voluntary basis) not less than fourteen days before embarkation, unless vaccinated within two years (does not apply to N.W. Europe).

Primary vaccination is by one insertion, $\frac{1}{4}$ in. long.

Revaccination is by three insertions, $\frac{1}{4}$ in. long, and 1 in. apart. This is in accordance with the instructions given to public vaccinators in the Vaccination Order 1930.

This procedure is simpler than the old; the assessment of results is made easy, and the smaller number of attendances required of those vaccinated does away with much of the administrative difficulty. Broom (1947), as a result of his experience of the revaccination of 1,227 displaced persons in N.W. Europe, writes favourably of it.

Vaccination remains the sheet anchor of the Medical Services in their campaign against smallpox. It cannot be claimed to give 100 per cent protection, but will limit the spread of the disease in a vaccinated community, and will modify its severity in such cases as occur.

Since vaccination has been put upon a voluntary basis by the National Health Services Act 1946, the ideal of having the Army as a 100 per cent vaccinated community is made more difficult to achieve. The question of whether or not it is justified to vaccinate a population which is chiefly exposed to variola minor, and thereby run the risk of causing a few cases of encephalitis, does not arise in a military community which is likely to be exposed to variola major.

Medical officers, who are the only propagandists for vaccination, will, because vaccination has been made voluntary, have to increase their powers of persuasion to make possible the goal of 100 per cent vaccination. Whether or not it will prove possible to reach this goal, and in the circumstances it seems hardly likely, nothing less than 100 per cent vaccination must content the medical authorities. Particularly must the campaign for vaccination be prosecuted among the families, so that children may be vaccinated in infancy, because the incidence of encephalitis is principally upon those primarily vaccinated after the first few years of life.

As an increasing number of recruits will be vaccinated for the first time, the number of cases of encephalitis following vaccination may be expected to rise. The incidence of encephalitis is approximately 1 per 100,000 vaccinations, and, from the military point of view, a few cases of encephalitis are a small price to pay for a protected community. Any such rise in the number of cases will bear hardly upon a few individuals, affect adversely the campaign in favour of vaccination, and add a further burden to those already carried by the unfortunates whose duty it is to prepare answers to Parliamentary Questions.

Vaccine Lymph.—If vaccination is to remain, as it ought to remain, the chief protection of the Army against smallpox, then the supply of calf lymph becomes a question of importance.

During the last war, there were three principal sources of calf lymph; in this country, the Government Lymph Establishment (in future, it will be the Lister Institute); in the Middle East, the Government Lymph Centre, Jerusalem; for India and the Far East, the Government Vaccine Laboratory, Kasauli, and, later in the war, other Government Laboratories in India. As two of these (Jerusalem and India) may soon cease to be sources of supply for the British Army, it is obvious that methods of provision for future wars must be considered. In peacetime there is no difficulty, because lymph can be sent out from home in cold storage by mail steamer or by air.

Bound up with the question of the source of supply is that of the distribution of calf lymph, and, therefore, of its keeping qualities. As the endemic foci of variola major which the Army is likely to encounter are in the tropics and subtropics, the distribution of calf lymph which shall be potent when it is used may be often extremely difficult.

The keeping properties of calf lymph are:—

- (i) At 0°C—for long periods.
- (ii) At 0°C—5°C—for three months.
- (iii) At 5°C—10°C—for four weeks but guaranteed only fourteen days.

It is therefore desirable to keep lymph at 0° C. or below; in transit to medical units it should be packed in cotton-wool soaked in iced water in an insulated container, or, better, packed in dry ice. On arrival, it should be stored in a refrigerator, in the "freezer" or, if no refrigerator is available, in an icebox directly on the ice. It must be used immediately after being taken from icebox or refrigerator.

Distribution by air is obviously the method of greatest value over long distances in tropical climates.

Recently much work has been done on the preparation of a bacteria-free vaccinia virus by propagation on the chorio-allantoic membrane of the developing chick embryo (van Rooyen and Rhodes, 1940). The advantages of such a lymph to the Army are clear. It can be obtained bacteria-free, it is relatively simple to prepare, it is cheap and obviates the need for calves (a great advantage in the tropics). Finally, if at any time an extraordinary demand for vaccine arises, this can be quickly met by inoculating sufficient eggs. If experience of human vaccination with egg-culture virus proves sufficiently favourable, it should at once replace calf lymph for military use.

Another line of research, with which the Army Medical Service should keep in close touch, is that directed to the production of a dried lymph which will keep indefinitely without losing its potency. The value of such a lymph to an Army in the Field, in case of storage and distribution, would clearly be immense. In the Belgian Congo, from 1930 to 1932, nearly a million people were vaccinated with dried lymph for, owing to the absence of cattle, fresh lymph was unobtainable, and the climate causes a rapid deterioration of fresh lymph when transported over long distances. (League of Nations Epidemiological Report 1934, Nos. 7 and 8). In India, Boulnois (1936, 1937) found that dried lymph afforded protection against smallpox to 98 per cent of individuals during the first year of life, and 30 to 50 per cent after the eighth year. Its use did not provide complete immunity against attack, as certain persons, forty-seven days after inoculation with dried lymph, developed smallpox after contact with a confluent case.

Intradermal inoculation is mentioned here for the sake of completeness: its use is not advised; "calf lymph cannot be guaranteed to be always bacteria-free: we should consider their presence a sufficient deterrent to militate against the use of the injection method for public vaccination" (van Rooyen and Rhodes, 1940).

(7) *Propaganda and Education*.—It has already been pointed out that, as a result of the revocation of compulsory vaccination, it will be more difficult to maintain a high level of vaccination in the Army, and that much responsibility for persuasion and education will fall upon medical officers in charge of troops and families.

If they are to carry out this work satisfactorily, they themselves must be convinced of the value of vaccination. Therefore, medical officers, on joining the Army, should receive special instruction in the diagnosis of smallpox and on vaccination; instruction should include the case for vaccination in the Army, methods of vaccination, assessment of results, revaccination, and the importance

of educating troops and their families in the value of vaccination. Medical officers should be trained to give this education, both by lecture and by individual persuasion and precept in the course of their duties; special attention should be given to soldiers and their families who are about to go abroad.

To help medical officers, Army Training Manuals should state clearly the case for vaccination, lay down precise instructions for its performance, and give facts and figures upon which propaganda talks may be based.

Full use should be made of additional methods of education, such as training films, posters, and leaflets which explain the necessity for vaccination to those about to go overseas.

Direction of the campaign against smallpox, and in favour of vaccination, should be the responsibility of hygiene officers, who must seek so to direct the educational campaign as to keep the vaccination state of troops and families at the highest level, thus ensuring the maintenance of herd immunity to smallpox. They should also ensure that medical officers use every opportunity of seeing smallpox cases, and that, when cases are not available, instruction in diagnosis is given through the medium of diagnostic films, photographs and demonstrations. A supply of literature relating to smallpox should be accessible to all medical officers.

(8) *Other Methods of Prevention.*—Space will only allow a brief mention of the other methods of smallpox prevention, all of which have their place, although they are secondary to the principal measure of vaccination.

Among them are: (i) Putting infected areas "Out of Bounds" to troops.

(ii) Exclusion from barracks and cantonments of native servants and hawkers during an outbreak of smallpox.

(iii) Anti-fly measures. There is evidence that flies may play a part in the transmission of smallpox (Rolleston, 1929); therefore, smallpox wards in tropical countries should be fly-proof, and full use should be made of modern insecticides, such as D.D.T.

(iv) Discovery of the source of infection.

(v) Control of outbreaks among school children.

Cases of smallpox may occur in children attending military schools. If a school child contracts smallpox, every effort should be made to have all others in the school vaccinated. It may be well to exclude actual contacts to reassure parents, though there is no other reason why contacts, who have been recently vaccinated with success, should be excluded.

Children's health can best be supervised at school, and school closure is inadvisable unless many are infected. Head teachers should send daily to the hygiene officer a list of absentees, so that these children may be visited by a medical officer.

(9) *Aids to Diagnosis.*—To be of help in the prevention of smallpox, laboratory aids to diagnosis should (i) give a positive result, before the appearance of the rash, in smallpox affecting contacts and (ii) give a positive result in the often difficult differential diagnosis between chickenpox and modified smallpox, or alastrim. No laboratory test yet devised will fulfil the first requirement, though

van Rooyen and Illingworth (1944) claim that they can make the diagnosis—as a result of demonstrating Paschen bodies in scrapings from papules.

The complement-fixation test, using fluid obtained from vesicles or pustules, may prove to be of value in differential diagnosis. In the opinion of Downie (1946), this is the most valuable single laboratory test at present available in the diagnosis of smallpox. The test may be used from the early vesicular to the crusting stage of the rash, and a report given in twenty-four hours. Neither of the above tests will distinguish between vaccinia and variola.

While laboratory tests have not yet been so developed that they are in general use, the service in early and positive diagnosis that they might give would be of great value. It is therefore important that the results of research into laboratory methods of diagnosis be closely followed by the Army Medical Services, so that any such methods, whose value is proved, may early be introduced into the practice of military laboratories, for the assistance of those who may have to make the diagnosis of smallpox and institute preventive measures.

CONCLUSIONS.

No attempt will be made here to summarize all the methods for the prevention of smallpox which have already been examined. It is intended to present only those points which appear to deserve special emphasis because of their importance in military planning for the control of smallpox; methods which are well established as part of a general routine will be omitted.

(1) Vaccination is important above all other methods for the control of smallpox. The target for the Hygiene Services of the Army must be to obtain 100 per cent protection by vaccination. Because of the abolition of compulsory vaccination by the National Health Service Act 1946, the importance of the points stressed in (2) is greatly increased.

(2) The Hygiene Services must have a vigorous policy of education and propaganda in favour of vaccination. This shall include not only the instruction of soldiers and their families, but also the training of medical officers, by clinical demonstrations, films, photographs and lectures, in the early diagnosis of smallpox and its prevention.

(3) A policy must be laid down for the provision of vaccine lymph to garri-sons abroad, and to possible theatres of war. Investigations into the possibilities of using dried lymph and egg-culture virus must be made.

(4) Methods of laboratory diagnosis must be introduced, as soon as is practicable, for the confirmation of the diagnosis of atypical smallpox.

(5) In view of the importance of the international control of smallpox, and of the overlapping in function between the Medical Department of the Army and the Ministry of Health, both of which have their part to play in that control, there should be a periodic exchange of medical officers. The purpose of this exchange would be to give workers in the civil and military branches of preventive medicine an understanding of each other's work, and to ensure a close liaison between them.

(6) Regulations for the Medical Services of the Army should be amended to include the instruction that attendants on smallpox cases should wear masks.

SUMMARY.

An attempt has been made:—

- (i) To show that smallpox continues to be a danger to the Army.
- (ii) To show how smallpox may affect the efficiency of the Army, and to examine, in the light of modern practice, the military measures for the control of the disease.
- (iii) To present certain conclusions which are important as regards future planning for the prevention of smallpox in the Army.

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Clinical and Other Notes.

THE BACTERIOPHAGE TYPING OF EUROPEAN AND NORTH AFRICAN STRAINS OF *BACT. TYPHOSUM*.

BY

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DURING the years 1943 to 1946, 286 cultures of *Bact. typhosum* were sent for bacteriophage typing to the Emergency Vaccine Laboratory, Everleigh. These cultures came from Army laboratories most of which were overseas in countries in which British troops are still serving. Therefore the following bacteriophage types found in the various areas may be of epidemiological interest in future outbreaks of typhoid fever.

BACTERIOPHAGE TYPES OF *Bact. Typhosum*.

Source of cultures	Number of cases bacteriophage type													Not typed		Total
	A	B	C	D	E	F	G	H	J	L	M	91	Imperfect	Vi	Forms	
ENGLAND			1		1	1						1				4
NORTH-WEST EUROPE																
Military cases—																
(a) Outbreak in unit "A"	—	—	—	—	69	—	—	—	—	—	—	—	—	—	—	69
(b) Outbreak in unit "B"	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—	5
(c) Not noted as connected with any outbreak	4	—	2	—	10	—	—	—	—	—	—	—	4	—	—	20
Civilian cases—																
(a) Rouen Area ..	..	—	—	1	—	2	—	—	—	—	—	1	—	—	—	4
(b) Holland ..	..	1	—	1	—	—	—	—	—	—	—	—	—	—	—	2
(c) Berlin Area ..	..	1	—	1	—	2	1	—	—	—	—	2	1	—	1	9
(d) Hamburg Area ..	..	—	—	4	4	—	—	—	—	—	—	—	—	—	1	9
(e) Germany (areas not stated) ..	..	—	—	—	—	—	—	—	—	—	—	—	6	—	—	6
Displaced Persons ..	..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Camp outbreak in Germany	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	4
Prisoners of War—																
(a) From France ..	..	—	—	2	—	3	—	—	—	—	—	—	—	—	—	5
(b) From Germany ..	..	5	—	1	1	11	1	—	—	—	—	2	8	—	—	29
ITALY																
(a) Outbreak in Rome Area	—	—	—	13	—	—	—	—	—	—	—	—	—	—	—	13
(b) Outbreak at Rimini ..	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	3
(c) From a ship ..	..	—	—	3	—	—	—	—	—	—	—	—	—	—	—	3
(d) Civilian and Military cases not noted as connected with any outbreak ..	..	13	—	6	11	10	—	—	—	—	—	1	2	—	2	45
MIDDLE-EAST FORCES																
Central Path. Lab. Cairo..	14	—	4	16	2	—	2	—	1	—	—	—	10	—	—	49

Source of cultures	Number of cases bacteriophage type												Not typed		Total
	A	B	C	D	E	F	G	H	J	L	M	91	Imperfect	W	
TUNIS AREA	•														
Prisoners of War ..	1	—	—	1	—	—	—	—	—	—	—	—	—	—	2
GIBRALTAR ..	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
WEST AFRICA..	1	—	—	3	—	—	—	—	—	—	—	—	—	—	4
Totals ..	40	—	19	55	123	3	2	—	1	—	—	8	31	4	286

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“NOW—WHEN I WAS THERE . . .”

BY

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EVERY single characteristic of Johnny H. was a substantial peg on which to hang a legend. His shambling bulk, his imperturbable amiability, his unerring appraisal of a situation, even his nickname—“The Little Flower”—were sufficient to make him prominent in an embattled Arakan. When the Colonel told the story of Johnny’s reluctant grapple with the Charpoy Cobra we laughed immoderately. Knowing the protagonists it was easy to see that the really humorous aspects of that passionate dilemma could never adequately be translated into speech. One anecdote flowed casually into another, and laughter being very near the surface, we tumbled over each other to tell of the exploits, either shared or hearsay, of that brave and beloved fool.

That is all of us except two, who being very young and new to the Service sat and looked at us with a compound regard of polite interest, disciplined resignation and youthful impatience. It was the identical look with which we had listened during our own apprenticeships to the interminable, *deathless* sagas of the Hills and the Plains.

It is never a pleasant nor flattering realization to metamorphose suddenly from being bored to being the bore. The perception of that look and all its implications rang down irrevocably the curtain on a colourful decade. During the last eight years the minutes have ticked relentlessly on, and although one has no regrets for the hair greying at the temples or a more than incipient double chin, we mourn the passing of moments and men who are already part of a rapidly fading yesterday. Of course, in the Mess, we were talking about the war, this last war, the war that is now the historical pabulum of to-day and

to-morrow. Most of us have no particular affinities for the occasionally necessary crudities of mutual destruction, but for all of us this thing had happened. had bitten a large slice out of our carefully organized lives, kneaded it and remoulded it with a diversity of outlandish ingredients, and had replaced it as an irritant foreign body in our intellectual and emotional make-ups. One day, time and the Army List being kind, when we have become reasonably senior "Old Men," saluted respectfully in public and dissected irreverently in private, the first Global War will have become merely a matter of maps, pricking with arrows of varying breadths, a collection of multicoloured isotypes, and the discarded plaything of a statistician. The pundits will talk gravely of economic causation, retrograde nationalism, the power politics of the atom and, with the sublime presumption of all pedagogues, professing omniscience, will know just a little more than nothing of the reality of a war.

Posterity always tends to look back on a victorious campaign as if it were the façade of a fine mansion set in a wooded park. It sees only the clean spacious outlines, the harmonious integration of wood and stone, the appropriateness of triumphal arches. It ignores the earthy intrigues in the mistress's boudoir, the petty larcenies of the butler's pantry and the multifold activities in the kitchen garden. We, who have lived through an epoch, however small and individually unimportant the parts we played, were still elements of the living matrix of history. As such we have contributed something to the future, whose historians can only guess at what we know.

It will never appear in textbooks that a German Army H.Q. was destroyed because a bomber-pilot had bungled a date with a W.A.A.F., that a critical campaign was in jeopardy because one general didn't like another's accent, and that the mainspring of victory was the patent trinity of a cigar, an obsession and a beret. Will the next generation ever know that success was not a decisive, clear-cut mathematical positive but only myriads of small, blurred negatives which unrelated but superimposed gave somehow miraculously the same unequivocal result? All the millions of little personal histories will be forgotten, and that is why, before the outlines of memory become distorted. I want to recall and savour again a few of the incidents which make it possible to fix in my mind an appreciable portion of a lifetime.

The first vivid memory in my scrapbook dates back to Dunkirk. On 3 Corps beach I felt miserably and deservedly sick. That was mainly because whilst passing through Poperinghe the medical orderly and I had made a gluttonous meal of Mars bars and champagne, which we had smugly rescued from a bomb-damaged and desolate N.A.A.F.I. He, swathed in a white blanket, and I, huddled in an anti-gas cape, squatted in the middle of our battalion's survivors and waited exhausted but unable to sleep for the first light and the possibility of rescue. When there were no boats we shaved and argued the whys and wherefores of that precipitate retreat to the coast. Then at last under a grey sky a fantastic flotilla of salvation nosed its way into the shore. We tried to be calm and remember our responsibilities, but uppermost was always the thought that only a few yards away over the shingle and the sand and the débris-littered narrows of oily water was the last chance for freedom—

a gate which an unlucky moment's delay might close for ever. We were patient because we had to be, and eventually as Dunkirk burnt and the smoke spiralled into the air behind us, we scuttled over the wreck of the Mole, snatched tins of condensed milk from a dump, and hurled ourselves on the deck of the destroyer "Vimy." Bending down to pick up a tin of cigarettes, my orderly had his legs shot away from under him, and yelling and cursing with pain and excitement he was dragged unceremoniously on board as the "Vimy" began to zigzag away to the open Channel to evade the double assault from the coast and the air. Back on shore a very gallant naval officer continued to cycle, as he had done all day, calmly and unhurriedly along the quay on his evacuation duties. Meanwhile Oerlikons, Brens, A-A guns and rifles combined in unholy disharmony, and we, not knowing our destinations and not caring, lay propped up on the decks, sipped mugs of steaming cocoa and smiled fatuously up at the lowering clouds and sideways at each other.

The next few months were vague. They seemed to be made up of night exercises, regimental dances and the Band playing tattoo in the market square. But then came a Saturday night in September, 1940. We were all at a road-house on the Leeds-Selby road celebrating Quebec Day, a traditional battle-honour of the regiment, and it seemed queer even then that one had to switch wars in order to provide an excuse for entertainment. The first sign that it was not to be an ordinary evening was when it was noticed that at one moment all our R.A.F. guests were there, and the next they were not. Before this had time to sink in the Adjutant appeared from the telephone booth and told us individually to report back to Battalion H.Q. To all my inquiries I received a single muttered word "Cromwell" from a pallid and harassed I.O. who left me as ignorant as before. The C.O. knew as little as anybody, but he assured us with statesmanlike confidence and sang-froid that the situation was at once grave and urgent. We were given two hours in which to discard everything but essentials, and the battalion was instructed to form up in line of battle along the main road facing south. The men were all billeted out, and it was impossible to keep a manœuvre of this nature entirely secret. At two in the morning that quiet little Yorkshire town suddenly became alive with activity. Carriers spluttered into noisy life and cluttered round the Abbey, and men doubled over the cobbled street. Windows were flung open and there were a hundred tearful, tender and tremulous farewells. Naturally, the rumour had gained credence that the enemy had secured a foothold on the coast. Since we could neither refute nor confirm this we packed with a sense of finality and mixed exuberance. Emergency rations and grenades were issued and the general purposes ambulance, a laundry van impressed for war service and freshly camouflaged, was stripped for action. I soon discovered, however, that the stretcher-bearers, loath to leave their band instruments behind, had reloaded them on the truck in the firm belief that they would be invaluable to morale in repelling the invader. Wondering and expectant, we waited on the road till dawn. Shortly afterwards came the orders to stand down till further notice, and after some days of fruitless speculation "The Night of the Long Knives" passed into obscurity as a minor regimental mystery.

A year later I was attached to a General Hospital as part of a convoy in the South Atlantic, two days off the Cape. On a cool blustery afternoon two ships at opposite ends of the convoy were crippled and destroyed by the agency of either mines or torpedoes. As a result the "Capetown Castle" on which we were fortunate enough to be travelling was ordered to proceed alone at full speed to Durban. In that gay and delightful city, recovering from the successive onslaughts of the Anzacs and the veterans of Madagascar, we heard all that popular rumour had emphatically stated had happened. That we had been lost at sea was inevitable, but there appeared to be some truth in the idea that all our carefully and laboriously acquired hospital equipment had gone down with the ill-fated freighter. That fact may have accounted for the later dispersion and harrying of our medical personnel over the length and breadth of India. But for the moment Durban claimed us, and claimed us for ever with a hundred exquisite memories. A certain very bright dawn we walked back to our quarters in the Royal Durban Golf Club from an all-night party which the gregarious Durbanites had seen fit to give us. Tired and contented we might have ambled drowsily across the racecourse track without comment but for the sight of "Tash." He was a subaltern in a Light Infantry regiment and with the determined aggressiveness of a certain type of small man he was always unpleasantly obvious. At that particular moment he lay curled up sleeping between the rails, a double Sam Browne carefully adjusted over a nude and hirsute torso, clutching in one hand a lady's short fur cape and in the other an empty, unlabelled bottle. We often attempted to find out why. No matter where you started, with the cape, the bottle or the bizarre deshahille, you were faced with an infinite choice of permutations. He could give no help first, because he was apparently afflicted with a complete retrograde amnesia, and secondly, because he was doing penance in isolation for the rest of the voyage. Later on I met him when he was Assistant Beachmaster in the Arakan landings, and having extracted the story agreed that it had matured with keeping and deserved a much larger and appreciative audience.

Glancing over the hastily scribbled and fragmentary diaries of India, Burma and Assam, one is overwhelmed by the abundance of incident. There always seemed to be something happening that was new, and even if at times wretchedness and discomfort were unavoidable bedfellows, we were at least adding to a respectably increasing store of experience.

With a feeling of embarrassment I recalled the episode in a Dakota over Allahabad. At that time we were flying with a precious cargo of irascible V.I.P.s to a top-security demonstration of air-ground co-operation in Southern Bengal. Having some ready-packed personnel parachutes aboard we were asked to demonstrate parachute procedure in order to titillate the Delhi-jaded appetites of the completely uninterested passengers. The airfield at Allahabad was nominated as the D.Z., and we having donned our 'chutes the pilot steered in for the dropping run. I was "No. 1." We went through all the realistic routine preliminaries. When the green lights went on and the jumpmaster said "Go." I went. Having been trained for months never to hesitate at a jumping order, the action was purely automatic. It was only when the canopy bellied open

and I was drifting down safely that I awoke to the dangerous possibilities of the situation with a shocked and horrified surprise. However, I landed without any complications in a field behind the hangars, and after waving to a white smear of faces that crowded the jumping door of an agitatedly circling aeroplane, prepared for the prospect of reprimand and the barrage of irony, which in fact exceeded anything in my gloomy expectations.

In Calcutta in 1942 there were sporadic outbursts of rioting. During one of these episodes a Czech medical officer and I were trapped in a taxi in a narrow street off Chowringhee and surrounded by a solid press of hysterical and brickbat-heaving adolescents. We had no great inclination to draw our revolvers, but it seemed that something drastic would have to be done to relieve a situation which was rapidly deteriorating. The Czech solved the problem. He stood up in the open car and began to harangue the crowd in a hotchpotch of English, Czech, German, Russian and Urdu. What he said was unintelligible, but it was impassioned and so very obviously sincere. At intervals throughout this linguistic *tour de force* was heard the international clarion call "Liberty, Equality and Fraternity." Ranting and declaiming to such effect he hushed the jeers, which changed to silent approval and eventually to a tumultuous roar of cheering. The revolution had found an unexpected champion. Some hastily discovered garlands were thrown round his neck, his admirers attached themselves to the running board, and we were escorted in triumph to the gates of the Military Hospital. As I passed through, relieved and perspiring, in the shadow of a great man, he smiled impishly and admitted that he had been reciting with histrionic trimmings the multiplication tables of his multilingual childhood.

Early in 1944 the Japanese 18th Army made a swift, determined and almost decisive thrust across the Chindwin to Manipur. Amongst the formations which were caught up in the succeeding maelstrom of events was our independent composite brigade. After a self-crippling defensive action which held up the enemy for a few precious days, the brigade was instructed to extricate itself as best it could from an untenable and profitless situation. So it came about that some days after a night withdrawal from the original position a small party of us, the survivors of a widely scattered unit, staggered in the twilight from the sheltering jungle-scrub into the irregular compound of a Naga village. Hunger and thirst had become torturing realities. After almost a week of constant ambush and evasion we were only kept going by the desperate urgency to remain uncaptured and to make the rendezvous at Imphal. In the process we had suffered. We had not scrupled to chew the tasteless, charred remnants of biscuits that we had found on the scorched bodies of our soldiers trapped and burnt by the enemy, nor had we worried overmuch about hygiene when we had crawled on hands and knees to lick up the fetid water which had collected in the deep imprints of animals' hooves at mudholes. We may have only been minutes ahead of Jap patrols when we reached the village, but that consideration was ignored in the mind-consuming thought that here at last was water, food and a little rest. The Nagas were unbelievably generous. In a little while they had prepared curried wild sucking pig, sweet potatoes flavoured with

rock salt, which they could ill-afford, and bamboo gourds of that potent distilled rice beer, zu. The first mouthful of meat was indescribably delicious, but it was so highly spiced that we had to swallow large quantities of the milky zu to quench the inferno in our mouths and stomachs. And so it went, alternate handfuls of pork and long heady draughts of zu. Finally we stretched out replete, bemused and entirely oblivious of the jungle war. We might have stayed there dozing indefinitely in the gathering darkness, if suddenly a little Naga boy had not burst into the clearing and told the elders amid much consternation that a Japanese party in what was presumably platoon strength had been reported in a near-by village down the track. We looked at each other unconcernedly. A paratroop major limbered to his feet and said conversationally, "I've been pushed around enough by these little b——s. What say we go back and fix 'em—we could take them on all right." In our state of self-satisfied stupefaction it seemed just the right idea. We scrambled unsteadily to our feet, collected an assortment of guns, kukris, spears and hand-grenades, and prepared with a great deal of inconsequential chatter and hilarity to do battle. Fortunately the Nagas were more sensible than we were. Fearful for the treatment they might receive on our account when the Japs took over, they provided us with a guide and set us off on a little-known track that led to the outskirts of Imphal. Arms round each other's shoulders, happy and exquisitely drunk, we stumbled off in the moonlight into the dark and welcoming forest shadows. I think we hummed monotonously "Lily Marlene" until by silent tacit consent we all lay down by the track and immediately fell fast asleep completely regardless of danger. And that is how we were found the next morning by an advanced patrol of the Dogras, who escorted us, hangovers and all, to the sanctuary of "Catfish" Box. We chain-smoked cigarettes, read mail, shaved off with a certain regret those magnificent black beards, and squatted on the ground in the evening at an open-air performance of Greer Garson in "Random Harvest."

The official end of the war did not see the end of my own bizarre experiences. Only a short time ago I was stationed in Paris. I was alone in the office, and owing to one of the inexplicable eccentricities of French municipal government the electric light had been cut off. It was an autumn evening, and on opening the window it was possible to see a panorama of the Paris skyline in a symphony of blue and grey. There was about it an irresistible fascination, the nostalgic shades of Verlaine, Whistler and Chopin. A timid knock came on the door, and in stepped hesitantly Mlle Aurore. She was vague and colourless, with an age anywhere in the dreary, spinsterish wastelands of 30 to 50. As an irritatingly conscientious stenographer she had survived the inundations of three occupations, German, American and British, and was now engaged at some fantastic salary typing all day, for no obvious reason, copies of routine orders. She stared at me intently with myopic eyes as I stood behind the desk pinning together some reports and said, "Mon commandant, excuse me, but I have been hearing voices up here in my head all day. First they told me to put all the teacups in the toilet, if you will pardon the expression. Now they tell me to jump out of the window. I don't want to—but I must."

She whimpered a little, placed a chair carefully near the window and clambered up on to the broad sill. I stared at her open-mouthed, and then realizing that this was exactly the sort of situation which, by virtue of my professed leanings, I should be expected to handle, I walked warily over to her, persuaded her to step down and guided her to an armchair. She gently took my hand away from her shoulder and said sweetly and very simply, "Ah, you must not be tempted by these sudden lusts. You know, of course, that the General is the father of my poor unmarried sister's child. You all are." She began to improvise on this unhappy inspiration, and sketched an intriguing new portrait of the sex lives of all the most senior officers in the H.Q. After some minutes we all agreed, Aureore, the voices and I, that perhaps it would be better if she saw her doctor and rested at home until she felt fully fit to return to work. She sobbed bitterly at the sudden thought that she would miss her daily tea and cakes, but brightened up considerably when after cocking her head sideways and listening intently she told me with dignity that I had no right to detain her in that ungentlemanly manner, as King George, who had been waiting all day to see her home, was becoming impatient. As soon as she had closed the door with an intimate little smile, I called up the O.C. Civilian Labour Unit to discover the subsequent procedure. The following conversation went something like this:—

O.C. P.C.L.U.—"You say she threatened to throw herself out of the window?"

H.P.—"Correct."

O.C. P.C.L.U.—"What floor are you on?"

H.P.—"The Fifth."

O.C. P.C.L.U.—"Well it's frightfully simple, old boy. All you do is to take Mata Hari down to the ground floor and then give her notice."

A short time afterwards poor, addled Aureore was returned intact to the genteel and discreet nursing home from which the collapse of France and the onrush of the Panzer-wehr had unexpectedly liberated her.

I imagine there is material enough in any of our war experiences to provide unique and fascinating autobiographies. And yet occasionally one hears voices, real voices, which say "Why don't you grow up? You are living in the past, playing at toy soldiers in fancy dress. That is finished. This is the real life." When I look critically at the post-war world, I tend to cling more tenaciously to my memories, because in those momentous days the issues were clear-cut, the goal straight ahead, the virtues fundamental and simple, and there was no time for little minds. Now we are confronted with a situation where our wearisome old acquaintances, the regimental psychopaths, have blossomed into spivs, monied, over-elegant and publicized, where pimps and trulls with all the temporary trappings of authority strut across the international stage, and where national and racial paranoia is shattering the promise of the future. The day after to-morrow the medals will be tarnished and the battles forgotten, but for those of us who were there, we shall remember the men of yesterday, the vanished moments of high endeavour, and the basic truths which never die.

MILITARY NURSING THROUGH THE AGES.

BY

ANNE THOMPSON, *R.R.C.*

ALTHOUGH there is, apparently, no record of any sort of established nursing service in early times, there is no doubt that with all armies some provision was made for the wounded on the battlefield.

3400 B.C.-1200 B.C.: Sixty centuries ago in Crete, the standard of hygiene was definitely high, and it is safe to infer from this fact alone that there must have been some interest in, and arrangements for, the maintenance of health.

3500 B.C. Onwards: In Egypt, medicine was held to be of divine origin, and the medical practitioner and his attendants were more in the nature of priest and his satellites. It is probable, therefore, that attention of the sick and wounded on the battlefield was provided by the soldiers themselves.

2500 B.C. Onwards: The ancient civilizations of Chaldea, Babylonia and Assyria produced a period of great intellectual development, and also instituted a legalized medical service. It was a period of wars, massacres and pestilences, hence it is obvious that the highly qualified medical man must have had assistants of some sort, and having regard to the subservient position of women, it is most probable that these assistants were men.

The ancient Indian cultures produced a most comprehensive system of rules for the preservation of cleanliness within and without, founded on the belief that prevention of disease is more important than the cure.

Definite instructions are laid down for the nurse, which might well stand for the present day, as this extract from the Charaka-Samhita will show:

"Nurse: Knowledge of the manner in which drugs should be prepared or compounded for administration, cleverness, devotedness to the patient waited upon, and purity (both of mind and body) are the four qualifications of the attending nurse."

And again: "That person alone is fit to nurse or to attend at the bedside of a patient, who is cool-headed and pleasant in his demeanour, does not speak ill of anybody, is strong and attentive to the requirements of the sick, and strictly and indefatigably follows the instructions of the physician."

During the reign of Asoka, public hospitals, which were schools of medicine, were erected along all the normal routes of travellers, and skilful physicians and equipment were supplied at the expense of the State.

Our knowledge of the medical and hygienic customs of the Jews is taken mostly from the Old Testament: with their frequent wanderings, and captivities, it is safe to assume that much of their knowledge was acquired from other nations. The net result was a most comprehensive ritual which covered strict supervision of foods including inspection of meat, dietetic restrictions, laws of hygiene, segregation of those suffering from communicable disease, and subsequent disinfection. They were the first people to deal with infection in a rational manner.

Information regarding the medical and nursing work of China is of a later

period, though Shen Nung—known as the father of Medicine—ruled for a long period between 2000 and 1000 B.C. That their knowledge was intricate and advanced there is no doubt, though some of their theories are rather startling to us. One of their greatest contributions was massage, an art in which they excelled. This art was not brought into use in Europe until A.D. 1800!

The early phases of Greek medicine are much like those of other nations, but the god-like attribute of medicine was probably more pronounced. Æsculapius, the son of Apollo, was the great god of medicine, and the many temples raised in his honour provided a system almost of hospitalization. The priests of these temples were the physicians, and the many attendants and servants no doubt supplied the nursing care.

500 B.C. and After: It was with Hippocrates that the era of scientific medicine begins, and with it, in all probability, the foundation of improved nursing arrangements. He it was who rejected the supernatural origins of disease and taught that it was caused by a breach of natural laws.

His disciples were instructed in all the details of what we now term "nursing technique," and also in the value of observation of the patient's condition.

250 B.C. Onwards: Early data of Roman medicine is scanty, but there is evidence (somewhat legendary, it is true) that Greek medicine was introduced in the year of pestilence, 239 B.C.

However, it is with the Romans that we have our first records of Army nursing. There is no doubt that every previous civilization must have had some system of caring for the sick and wounded of its Army, but, apparently, it was haphazard and of a rough and ready nature, as no records have been traced.

Rome, however, instituted a definite system of hospital and services for its armies. It was an essentially militaristic nation, and its armies roamed over large areas, many of them almost barbarian in nature. Therefore, the Army was equipped most comprehensively for the care of its own sick and wounded. The fighting man was issued with the equivalent of a "field dressing," and had rudimentary instruction corresponding to first aid. Doctors were attached and, though they did not rank as officers, they had certain rights and privileges.

Every camp had its valetudinarium, with complete staff composed of administrators, doctors, and "those who wait on the sick." These last were probably slaves, but in their duties would correspond to the modern orderly. In the medical care of the Army, Rome spared no expense.

On the return of the Army to Rome, the sick and wounded were "boarded out" for each house of any size had its own valetudinarium, which normally was used for the sick of the household. The care of the sick in the house was the responsibility of the lady of the house and her female slaves. This custom may, therefore, constitute the origin of female nursing of the Army's sick.

A.D. 390: Later, the first hospital was built in Rome by Fabiola, but this was probably a public hospital for the poor: certainly not for the all-important soldier, who continued to receive the more specialized treatment of the valetudinaria.

The introduction of Christianity caused a great set-back to medicine which was pagan in origin with its conception founded upon and closely linked with

the worship of the pagan gods. With the advance of Christianity the obliteration of all signs of pagan worship was a natural result.

Yet it was the more fervent Christian followers in the early days who established various methods of administration to the sick, which have grown through the ages to the present system of hospitalization, medical and nursing care, health visiting, etc., etc.

The care of the sick was lifted to a higher plane, and each congregation had its "deacons" and "deaconesses" whose avowed duty it was to go outside the limits of their own homes and care for the sick. An exact date is difficult to ascertain, but there is no doubt that by the fourth century, organized care of the sick was an established fact and from then on one can trace the course of nursing to present times.

With the establishment of religious orders, the care of the sick became more and more the responsibility of members of these communities. There is little, if any, mention of medical and nursing care for the armies of the world, though one can gather that where a battle was fought in the vicinity of such an establishment, succour was given to the wounded, after the battle, by the members.

It was not until the twelfth century that the era of the true hospital begins, and with this we find various religious orders, whose main duty was the care of the sick, and, from the military point of view, the establishment of the Order of the Knights Hospitallers is the most important.

The Crusades constituted the direct reason for the founding of the military nursing orders. With the capture of Jerusalem and the establishment of a Christian Kingdom in 1099, the Order of St. John sprang into prominence: the origin is somewhat obscure, some historians giving the credit to some Italian merchants, who in 1050 established two hostels at Amalfi for the use of pilgrims, though others give the credit to Peter Gerard.

The Order was divided into three classes, Priests, Knights and "Freres Sergents," or serving brothers, who did the actual nursing. The Order grew large and powerful, but with the conquest of Palestine by the Saracens, the Knights had to abandon all their possessions, and a few escaped to Cyprus.

Thereafter, their history was as romantic as it was varied. They held Rhodes from 1310 to 1522, when it was captured and they were compelled to leave. The Emperor Charles V then gave them Malta, where they stayed from 1530 to 1798, when they were turned out by Napoleon.

Their significance in nursing history is great. The Crusading spirit lent it a lustre which attracted the greatest in the land. The prestige was high, and influenced and stimulated all subsequent hospital organizations.

As the Knights were generally very wealthy, they were in a position to equip and maintain their hospitals far better than any other community.

There was a female branch of the Order, equally as old as the men's, and while in Jerusalem the Sisters nursed, but after their evacuation from Palestine to Europe, there is little or no evidence of their having continued their nursing.

The influence of the Knights Hospitallers spread across most of Europe, the Order of Teutonic Knights being a large and important subsidiary Order.

A third great military nursing Order, which also rose to importance during

the Crusades, was that of the Lazarists or Knights of St. Lazarus, whose main object was the care of lepers. With the decrease in the incidence of leprosy in Europe, this special need diminished, till in 1490 Pope Innocent VIII closed the Order and handed the possessions to the Order of St. John.

The progress of nursing through the Middle Ages depended almost entirely upon religious and secular orders, and was carried out almost entirely by women, and there is no doubt that these secular communities advanced the practice of nursing in no small measure. Little is known, however, about the military nursing of these days, and it would seem that the nursing of the sick and wounded of the Army was largely dependent upon either the good services of other soldiers or upon the camp followers—the motley collection of women of loose morals but of generous and kindly nature, which followed the Army wherever it went. Their professional knowledge was obviously non-existent, though possibly with time and all too much practice they attained a certain amount of skill. It may be added that even as late as 1846 their use was advocated by William Fergusson, the then Inspector-General of Military Hospitals in England. In fact, their presence was allowed only on condition that they nursed the sick and wounded.

There is no doubt that nursing as such was at a low ebb during the seventeenth and most of the eighteenth centuries. Conditions for nurses were such that only the poorest types would accept the work. The late eighteenth and early nineteenth centuries began to show greater advances than ever before. Reformers like John Howard (1727-1789) and Elizabeth Fry (1780-1845) worked indefatigably to improve general conditions for patients, and consequently their attendants. It needed the Crimean War to bring home to the world the necessity for improved conditions in the Army.

Army hospitals were in a deplorable state. Soon after the outbreak of the Crimean War, ugly rumours began to reach England of the neglect and mismanagement: one report from the special correspondent of *The Times* (October 9 and 12, 1854) said that in the hospitals were “neither surgeons, dressers, nurses, nor the commonest appliance of a workhouse sick ward.” Later, having noted that the French had the ministrations of the Sisters of Charity, he demanded, “Why have we no Sisters of Charity?”

Sidney Herbert, the Secretary of War, and Florence Nightingale, took up the challenge. His letter on the subject to Florence Nightingale, with a request for help in sending a staff of women to Scutari, is worthy of special note. “There is,” he wrote, “but one person in England that I know who would be capable of organizing and superintending such a scheme. If this succeeds, an enormous amount of good will be done now, and to persons deserving everything of our hands; and a prejudice will have been broken through and a precedent established which will multiply the good to all time.” With the acceptance of the post by Florence Nightingale, military nursing took one of its longest steps forward.

The difficulties she encountered, the prejudices she had to overcome, before she set off on October 21, 1854, with her little band of thirty-eight nurses are too well known to need further description. But the revolutionary aspect must be fully appreciated. WOMEN nurses in the British Army! Quite unthinkable

able! But the step was taken, and the gain to nursing in the Army in particular, and modern nursing in general, is beyond measurement.

The conditions on the arrival of Florence Nightingale and her nurses were indescribably bad. Equipment of any sort was practically non-existent, sanitation was appalling, and everything covered with filth and vermin.

A quotation from a nurse's letter is enlightening: "Generally speaking, the chief medical officers resolutely closed their eyes to the great want in the hospitals of every comfort for the patients: they would have said, from time immemorial a prescribed course has been resorted to in order to meet certain exigencies, and, if it did not meet them, it was supposed to do so: which was, they persisted, so far as they were concerned, the same thing." (One knows this attitude even in these enlightened times.)

Gradually, by almost superhuman efforts, improvements took place. Comforts (which were really necessities) were bought out of funds which had been given to Florence Nightingale for the benefit of the soldiers, and *The Times* instituted a fund which was administered by an official who was sent out and who worked in close liaison with her.

In addition to the nursing, she also instituted a scheme for the care of soldiers' wives. Another reform was the introduction of recreation and reading rooms, schemes which have stood the test of time and are still of incalculable value to the welfare of the Army.

Also, at her own expense, she fitted up a house to enable doctors to carry on their scientific studies. This small experiment was destined to be the nucleus of the Army Medical School.

The general improvement is, perhaps, best shown by the rate of mortality which fell from 42 per cent to 22 *per thousand*. In spite of her magnificent efforts, she was not given official status until February of 1856, when she was called "General Superintendent of the Female Nursing Establishment of the Military Hospitals of the Army."

After her return in August, 1856, she continued to work unceasingly for the improvement of conditions in the Army.

The total number of nurses by the end of the war was 125, and this formed the nucleus of the present Military Nursing Service.

Closely linked up with the advance in Military nursing during this period is the inception of the "Red Cross." With the many wars, various organizations for aiding soldiers had sprung up, but were chiefly for supplying material comforts. In many instances, however, the voluntary helpers concerned found themselves nursing the sick and wounded because of the lack of trained nurses.

French and Italians against Austria: The founder of what is known now as the Red Cross was a Swiss, Jean Henri Durant (1828-1910), who organized a band of amateur helpers after the battle of Solferino (1859). He published a book describing the sufferings of the miserable wounded of both armies, and then travelled widely to advertise his scheme for the prevention of such miseries. As a result of his activities, especially after a talk in person at the International Statistical Conference in Berlin, a member of the Geneva Society of Public Utility invited various governments to an International Conference to be held in Geneva in October, 1863.

The outcome of this was the famous Convention of Geneva which was signed in 1864 by twelve Powers. The distinctive mark for medical personnel was to be a red cross on a white field—the flag of Switzerland with the colours reversed.

The ultimate outcome was the International Red Cross Society as it was finally named. As regards its nursing activities, the Convention of 1863 mentioned only men nurses, but by 1869 the scope was more general, and resolutions were passed for the instruction in nursing of anyone who wished to serve from patriotic motives.

The degree of training varies in different countries from elementary nursing (this mainly in countries having an established military nursing service) to full and complete training to constitute the supply of trained personnel for the Army in time of war.

The activities of the "Red Cross" were not by any means confined to nursing. The administrative bodies have built up one organization after another to meet some particular need, with the consequence that during the recent war the personnel of the armies, whether sick or wounded or fit, were able to depend on them to an unprecedented degree.

DEVELOPMENT OF THE MILITARY NURSING.

It should be remembered that up to the period now under review there was no such thing as a "trained nurse."

Probably the first instance of an organized training was that of the well-known Kaiserworth. This institution, founded in 1836 in a very small way by Pastor Fliedner near Dusseldorf, introduced a definite system of training for its "deaconesses." Most of the nursing lectures were given by the Pastor's wife Frederike. The movement expanded and aroused considerable interest in other countries. Visitors came to study its methods and later experienced deaconesses were sent to start similar institutions in other localities. Elizabeth Fry, Florence Nightingale and Agnes Jones all spent some time there and built up their ideas for nurse training on similar lines.

In 1855 public opinion in England was resolved that there should be some concrete mark of appreciation of the work of Florence Nightingale in the Crimea. The result was the formation of the Nightingale Fund which was to be used by her to establish and control an institution for the training, sustenance and protection of nurses.

By the time she had reached England in July, 1856, the Fund had reached the sum of forty-four thousand pounds sterling.

A Royal Commission on "The Health of the Army" was set up in 1857 to inquire into the terrible conditions in military hospitals.

Scutari had demonstrated beyond all doubt that there was room, and great need, for women nurses in British Military Hospitals, and that a different and better type of women was needed to create the new order of nurses. They needed to be educated women willing to devote their lives to their work. They needed instruction in all the branches of science that enter into nursing and practical knowledge of ward and sickroom work.

Medicine and surgery were making great advances during this period and it

became increasingly evident that the nurses must have the necessary knowledge to appreciate what was being done for the patient, and to be able to carry out instructions intelligently.

The time was ripe for the introduction of the professional nurse of good character, with education and intelligence. Florence Nightingale set herself to found an institution on her own lines to impart the necessary training. She chose St. Thomas's Hospital, where the Resident Medical Officer, Mr. Whitfield, was fully in sympathy with her schemes, which was certainly not the case with many other medical men.

Also, she spent considerable time and thought with her matchless organizing ability to carry out a scheme for Army nursing, and managed against some opposition to arrange that women nurses should be employed in the General Hospital at Fort Pitt, Chatham, to look after the soldiers sent home from the Crimea.

On May 19, 1856, the foundation stone of the Royal Victoria Hospital was laid at Netley by Queen Victoria and a little later the Herbert Hospital (now the Royal Herbert) was started at Woolwich. Each of these hospitals was staffed with a Lady Superintendent and six to ten nursing sisters.

In 1860, the Army Medical School was transferred from Chatham to Netley and the nursing staff under the supervision of Lady Jane Stewart Shaw was also transferred.

In 1866 nurses were appointed to all Military General Hospitals, but it was not until 1881 that an Army Nursing Service was formed. Later, in 1883, it was ruled that all military hospitals having one hundred beds or more should have a nursing staff.

Originally, all nurses served a probationary period at Netley, and were then drafted to other stations. They were "responsible for the nursing of their patients, for giving them their medicines, food, etc., and also for the training of the orderlies in their wards."

This last is important, for it throws a light on the fact that previously the orderlies had had no training in nursing duties.

In 1884 a "Code of Regulations for the Female Nursing Services of the Army" was published, and it was then established that all Army nurses must have received previous training in a civil hospital.

At the outbreak of the South African War, 1899, the Army Nursing Service was:—

1 Lady Superintendent (at Netley).
19 Superintendent Sisters.
68 Sisters.

By the end of the war 22 general hospitals of 520 beds each had been established in South Africa alone. The Army Nursing Service had been augmented in various ways. Princess Christian's Army Nursing Service Reserve, composed of civilian nurses, with full or partial training, supplied a large number of the nurses required. Queen Alexandra (then Princess of Wales) arranged for the despatch of a draft from the London Hospital, and some were sent by various Colonies. Later many of these were absorbed into the Regular Service, while a large number remained on the Reserve.

Just as the Crimean War had brought home the need of nurses in the Army, so the South African War proved the necessity of a thoroughly well-organized nursing service. It proved how an efficient, well-trained, well-organized service would in every way help to increase the efficiency of the Army Medical Services at all times. With trained women, the nursing orderlies were in a position to learn to carry out their duties with knowledge and efficiency.

In 1902, the details of a new nursing service were formulated. Queen Alexandra displayed the keenest interest in this. "Queen Alexandra's Army Nursing Board" was formed, and Her Majesty permitted the new service to be named "Queen Alexandra's Imperial Military Nursing Service." She also became its first President.

The total number was about 300, with a Matron in Chief at War Office and two Principal Matrons, one at War Office and one in South Africa.

The Great War (1914-1919) required an enormous increase in staff, which was largely supplied by the Reserve which had been placed on a firm basis in 1913. In 1914, no less than 2,223 nurses were enrolled and by 1919 the figure had reached 10,404.

This number was further augmented by V.A.D.s of the Order of St. John of Jerusalem and the B.R.C.S., a total of 8,495 being employed to take the place of Royal Army Medical Corps orderlies.

Between the 1914-1919 war and the recent world war, many changes have taken place. In 1921 a service for Military Families Hospitals was established but this was amalgamated with the Imperial Service in 1927.

In 1926 the Military Nursing Service for India was also amalgamated. This, besides opening up a much wider field for the Army Sister, entailed a large increase in the establishment which in 1939 (before the war) consisted of:—

- (A) A Matron in Chief (at War Office).
- (B) A Chief Principal Matron (in India).
- (C) Six Principal Matrons.
- (D) Thirty-six Matrons.
- (E) Sisters, approximately 570.

From the commencement of the reorganization of the Army Nursing Services, improvements in the training of the R.A.M.C. orderlies naturally followed. Various sections were formed and though all orderlies were required to have the rudiments of nursing knowledge, the nursing orderly was now in a position to acquire a satisfactory and comprehensive training. The success of this has been amply proven by the fact that the General Nursing Council accepts Army training and allows those qualified to sit for their State Registration Examination without further training.

PROGRESS IN INDIA.

It was in the year 1926 that the first nursing service for the Indian Army was formed. It was named the Indian Military Nursing Service and was composed of 12 Matrons, 18 Sisters and 25 Staff Nurses, fifty-five in all—a woefully small number to be responsible for the hospital nursing of the Indian Army, and for the supervision, instruction and training of the nursing section of the Indian Hospital Corps.

Their scope was necessarily limited by their numbers, but their existence has been so amply justified during the recent war that their post-war position should be much more favourable.

The Indian nursing orderly has also proved an unqualified success. The Service, which is the outcome of the war, is known as the Indian Army Medical Corps and the personnel have benefited greatly by their travels and experience with the Army. Many are fully-trained nurses and hold Jemadar rank.

They have worked side by side with the R.A.M.C. wherever the two armies have fought together.

The enormous increase in numbers of both I.M.N.S. and I.A.M.C. has perhaps done more for the advancement of nursing as a profession in India than any other single factor. There is no doubt that conditions were, and still are, in a desperately low state chiefly due to lack of recognition of the very real necessity for trained nurses.

But, during the war, the temporary I.M.N.S. who volunteered for active service, many of them with training far below the accepted standards elsewhere, the untrained cadets of the Auxiliary Nursing Service, and the I.A.M.C. have had the opportunity of working with some of the best physicians and surgeons in the world.

The progress made in Medicine during the war was immense and its application was concentrated very largely on the treatment of the sick and wounded of the Army.

This provided most valuable training which was unavailable in many civilian hospitals.

GENERAL.

The work that has been done during the present war by the Q.A.I.M.N.S. and its Reserve, the T.A.N.S., the I.M.N.S., and A.N.S., by the nursing orderlies of the R.A.M.C. and I.A.M.C. and the V.A.D.s who volunteered in thousands, is too well known to require any amplification.

Where the Army went, the nurses went, women and men, trained and untrained. The nursing orderlies had the privilege of going farthest forward, they were right in the battle line, and their magnificent record of work and heroism under all conditions and circumstances is beyond description.

The Q.A.s were not far behind. They went as far forward as they were allowed, much farther forward than has ever been permitted in previous wars. They served with Field Ambulances on the Tiddin Road and in Arakan, and were once referred to as "The most forward young women in Burma." Theirs also is a record of which they can be eternally proud.

Both the Q.A. and the R.A.M.C. and the I.M.N.S. and I.A.M.C. appear to have a gift for getting on with any patient, of whatever nationality. They have had ample experience during the recent war of patients of every type, every nationality, every creed and colour, men, women, children, friend and foe, yet always the result was the same: A well-nursed, comfortable, happy patient.

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Reviews.

BRITISH JOURNAL OF SURGERY—WAR SUPPLEMENT NO. 1—WOUNDS OF THE HEAD.
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This is the first of four supplements which will deal with war wounds. It sets a very high standard for subsequent sections on abdomino-thoracic wounds, wounds of the extremities, and plastic surgery including facio-maxillary injuries.

Opening with a survey of neuro-surgery in the two wars, and of the history of the progress of the battle against infection, it goes on to a treatise on Neuro-Surgery in the Army, by the Army Consultant, which administratively and professionally will be of the greatest value to the Army now and in the years to come.

There are sections dealing with the various campaigns; forward surgery is discussed, as is primary definitive surgical treatment, and also the management of the late untreated case. The subject in all its stages and aspects is dealt with by British Surgeons, neurologists and bacteriologists who throughout the war years have rewritten the history of Army Neuro-Surgery.

The Atlas of Head Wounds illustrating standard technique is mainly in colour photography and is of the highest artistic and educational value.

This is a most important publication and its appearance at this comparatively early date reflects the greatest credit on all concerned. It is to be hoped that a copy will always be available in all military medical libraries and no Army surgeon can afford to be without one.

D. F.

THE CONQUEST OF THE UNKNOWN (Conquest Series No. 5). By George Bankoff, M.D., F.R.C.S. Macdonald and Co. (Publishers) Ltd. Pp. 169. Price 6s.

This book is described by the author as the story of the endocrine glands, and is one of a series of six designed by the publishers "to make entertaining and lucid reading for the layman with no previous technical knowledge of the many wonders of contemporary medical science to-day." It gives a clear account of the disorders of the endocrine glands and an indication of what can be achieved by treatment. The information is set forth on broad lines in which past history and the prospects of future progress are represented. The part played by the endocrine glands in the interaction of body and mind, and questions of cause and effect relating thereto, are clearly discussed. Generous concessions are made to a psychotherapeutic approach in certain spheres in which physiological considerations appear at first sight to indicate a priority of endocrine factors, e.g. that of sexual aberrations, but the author, while assessing the rôle of each, looks ahead to a unified conception in which these will be "separate edges of the same sword" rather than "separate weapons of the doctor's armoury."

J. B.

A PRACTICAL TEXTBOOK OF LEPROSY. By R. G. Cochrane, M.D.Glas., F.R.C.P., D.T.M.&H.Eng. Geoffrey Cumberlege, Oxford University Press. Pp. 283. Price 42s.

This monograph provides information on every aspect of the problem of leprosy and bears the imprint of one who has made its study a part of himself. It well merits the claim to be practical, and a wealth of photographic reproductions illustrate details of the various aspects of the disease brought out in the text. In discussing the epidemiology the author stresses the importance of infection in childhood, the massiveness of the infecting dose and the closeness of contact. He shares the opinion advanced by Rogers that the *M. lepræ* cannot multiply and cause active disease unless they are disseminated by the skin. The occasional infection of Europeans living in the East is attributed to high individual susceptibility, and the writer records an impression that the severe lepromatous types of the disease form a larger proportion of cases in the European and Mongolian races than in the Indian and African.

Sixty-six pages are devoted to treatment which is prefaced by an examination of general principles embodying the necessity for a well-balanced mental approach and a clear understanding of the underlying pathological process. Ability to diagnose the type of disease accurately and confirm it histologically is stressed as a prerequisite. A cautious attitude is adopted towards the results claimed for the promin group of drugs, and the author states that, while six months are sufficient to disprove the value of a drug, two years are required for confirmation of any favourable results claimed. Practical methods of control are based on the proposed organization of the Leprosy Campaign in Madras Presidency. The book should bid fair to become a classic.

J. B.

A SYNOPSIS OF ANÆSTHESIA. By J. Alfred Lee, M.R.C.S., L.R.C.P., M.M.S.A., D.A. Bristol: John Wright and Sons, Ltd. 1947. Pp. 254, with 42 illustrations. Price 12s. 6d.

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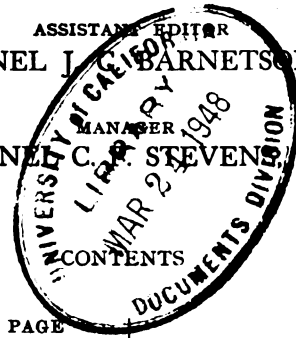
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Original Communications.

MALARIAL EPISODES.

A Clinical Study of Atypical, Pernicious and Lethal Cases Selected from among 10,000 Malarial Patients Admitted to Military Hospitals in Ceylon.

BY

Major E. SOYSA, O.B.E., M.B. Lond., M.R.C.P. Edin.

Ceylon Medical Corps; Medical Specialist, Ceylon Army Command (1942-1946).

THE common malarial episodes, when presented with an appropriate antecedent history, rarely escape clinical recognition. When persons who have been residents or transients in malarious zones, or those who have previously suffered from the disease, develop a paroxysmal fever, initiated by chills and rigors, accompanied by splenic symptoms and indications of anæmia, malaria obviously suggests itself as the cause of the illness. Previous experience of the disease may teach a patient to recognize the symptoms that occasionally signalize an impending attack—malaise, lassitude, anorexia, headache, myalgic discomfort—sometimes showing a perceptible periodicity in incidence or intensity. Such a prodromal phase is generally inconspicuous or entirely lacking, and the patient is usually taken unawares by the fever, which is soon accompanied by constitutional disturbance of varying degree.

Although definitive diagnosis demands the demonstration of malarial plasmodia in the patient's blood, the disease so often presents its dominant clinical features in typical form so as to render clinical diagnosis easy and reliable. Malaria is the only disease with a fever of tertian or quartan periodicity; even in the subtertian and quotidian forms its typical three-stage paroxysm distinguishes it from other fevers; the clinical triad of fever, splenomegaly, and anæmia provides inferential evidence of plasmodial activity; and, finally, the response of the disease to anti-malarial therapy (particularly striking in subtertian infections) substantiates clinical diagnosis.

When, however, malaria presents its various atypical, and sometimes baffling, episodes, it may quite easily lead to erroneous clinical diagnosis. Such anomalous and variable behaviour of the malarial parasites is usually due to their tendency to recede from the peripheral to the visceral circulation, provoking symptoms referable to the particular viscus in which they may sporulate. Consequently, these atypical malarial manifestations may be as widely divergent in nature as, for example, psychotic disturbance and

pulmonary embarrassment, or nephrotic insufficiency and pseudo-cholera, or algid collapse and hæmoglobinuria. Furthermore, the diagnostic difficulties are enhanced by the occasional failure to detect malarial parasites in the blood in some of these cases, and precious time may be lost in futile therapeutic effort directed against some other pathogenic agent, the effects of which may have been simulated by the malarial plasmodium which has escaped suspicion.

When we include the various sequelæ and complications that follow in the wake of this disease, the atypical episodes that may be attributed to malaria are truly protean in character. Though, fortunately, relatively infrequent in incidence, these episodes may be responsible for a significant contribution towards the morbidity and mortality of malaria through their malignant and pernicious effects. To illustrate the diversity of these unusual malarial episodes, and to emphasize the clinical interest they afford, a few selected cases are here presented. Some of the reports are, admittedly, incomplete as a result of the widespread local prejudice against necropsy, and this must be the apology for the unfortunate lack of post-mortem study of some of the fatal cases here recorded. With the exception of one case (Case 6), all patients in this series were soldiers admitted to two military hospitals where no less than 10,000 cases of malaria were treated between January, 1942, and February, 1946, the majority being Ceylonese of various races.

APYREXIAL EPISODES.

Although fever is the most conspicuous manifestation of clinical activity in malaria, afebrile episodes occasionally occur, as in cases of ambulant malaria, latent or dormant malaria, incompletely suppressed malaria, masked malaria, chronic malaria, myalgic types of malaria (Hughes and Bomford, 1944), subclinical malaria (Ferriman, 1945), etc. Despite the absence or insignificance of fever in these cases, malarial parasites may lurk in the blood of such patients for long periods without seriously impairing health. Attention is usually drawn to the condition by recurrent complaints of malaise, accompanied by headache, backache, myalgic discomfort in the neck, chest, trunk, or limbs. The disability may progress to acute tenderness, spasm, and limitation of movement of the affected part. Constitutional symptoms are absent or inconspicuous, anæmia is rarely obvious, except in chronic cases, but tenderness or enlargement of the spleen, and discoloration of the urine by urobilin should direct suspicion towards a malarial pathology. In contrast to the inefficacy of the common anti-rheumatic remedies, the prompt response to anti-malarial therapy is striking in these cases. The importance of careful search for evidence of malaria is illustrated by the following case:—

Case 1. Apyrexial Malaria.—A Gurkha rifleman, aged 20, was referred for investigation as a suspected psychoneurotic. He had reported sick frequently with complaints of aching in his head, spine, and limbs, during the preceding two months or more. Observation in hospital on two previous occasions had shown no evidence of fever or other symptom, apart from stiffness and tenderness of the muscles of the back and limbs. Examination in various specialist departments had revealed no obvious cause for the symptoms. Laboratory investigation had disclosed no pathological abnormality of significance. *Blood:* W.B.C. 6,700 per c.mm.; D.C.—P. 60 per cent, L. 36 per cent, M. 3 per cent, E. 1 per cent; R.B.C.

3½ million per c.mm.; Hb. 75 per cent; malarial parasites nil. *Urine*: Albumin, sugar, bile, nil. *Fæces*: Amœbæ, ova, cysts, nil. Symptomatic treatment with salicylates and sedatives had produced no effective response apart from temporary relief. The patient's mental outlook was influenced by an excusable degree of anxiety about his physical symptoms, which he feared might interfere with his Army career; but this anxiety seemed more likely effect rather than cause in relation to his disability. As this soldier had served in malarious jungles where he had experienced mild feverish attacks, for which he had not reported sick, and as a perceptible periodicity was detected in the recurrence of his present symptoms, a careful search for evidence of malaria was recommended. The spleen was not enlarged, but was definitely tender to deep palpation; the urine was dark in colour, and was found to contain urobilin; after repeated examination of the blood, a few benign tertian rings were ultimately found in a smear. The patient was put on a full course of anti-malarial therapy and responded with a quick and lasting recovery.

HYPERPYREXIAL EPISODES.

At the other end of the temperature scale, malaria produces some of the highest temperatures recorded in febrile diseases, the thermometer rising to 110° F., or even higher. The possibility of this disease should be kept foremost in mind in dealing with any case of hyperpyrexia, whether of insidious or sudden onset, in persons who have been in malarious districts. The hyperpyrexial episodes of malaria rank among its most pernicious forms, sometimes defying the most energetic treatment, and occurring both in malignant and benign infections, as illustrated in Cases 2 and 4, respectively.

Case 2. Malarial Hyperpyrexia.—A Sinhalese Lance/Serjeant, aged 25, with no previous malarial history, was found to have a malignant tertian parasitæmia on the fourth day of a remittent fever, two previous smears having been negative. Quinine therapy was initiated orally, but as the fever rose to 105° F. an intravenous injection of 6 grains of the bihydrochloride was also administered. The temperature remained elevated for about four hours, and for the first time the patient complained of a slight, dull headache. His pulse-rate was 108 per minute, blood-pressure 100/70, and no neurological signs were present. Intravenous quinine was repeated, after a preliminary subcutaneous injection of adrenalin $\frac{1}{10}$, ice compresses continuously applied to the head and neck, and frequent cold sponging of the body carried out. After midnight, the temperature remitted to 101° F. and the patient was free from headaché by next morning. Thereafter, the fever began to mount, with remissions, and intravenous quinine was resumed, but with no effect. As the fever continued to rise, mepacrine 0.3 gramme was given intramuscularly with oral quinine grains 10 t.d.s., but with no response. Signs of cardio-respiratory failure appeared as the fever continued unabated, but cerebral disturbance, such as restlessness, confusion, delirium, or unconsciousness, were conspicuously absent until the temperature had risen past 107° F. Persistent treatment with quinine and mepacrine, with stimulants (digitalin, strychnine, nikethamide), oxygen inhalations, ice applications to the head and body as well as ice water enemata, failed to arrest the rapidly deteriorating condition of the patient. Lumbar puncture produced a clear cerebrospinal fluid, which was under slight tension; withdrawal of 13 c.c. was followed by no beneficial effect. As the temperature rose to 108° F. at midnight on the seventh day of the illness, death supervened from acute cardiac collapse, without the patient's temperature having once returned to normal since the onset of the fever.

ALGID EPISODES.

Occasionally one meets grave malarial infections where the patients do not complain subjectively of fever, but exhibit a cold, clammy skin, cyanosis, and symptoms of profound cardiovascular asthenia, with a tendency to

collapse and fatal syncope. Despite the extreme coldness of the body surface in algid malaria, the temperature may be found elevated in the mouth or rectum. A factor of grave prognostic import in these cases is the presence of a heavy parasitæmia in the peripheral blood. Algid manifestations often co-exist with the gastro-intestinal episodes of malaria, in which circumstances the symptoms have a frequent tendency to appear during the cold stage of the fever. When occurring independently, algidity sometimes follows the termination of a malarial paroxysm, especially when rapid defervescence has taken place with excessive diaphoresis. Prompt treatment directed towards both control of the infection and a stimulation of the circulation will often avert disaster, as in the following instance:—

Case 3. Algid Malaria.—A Sinhalese Serjeant-Major, aged 40, in hospital with his first attack of malaria, showed a very heavy infection of his blood with malignant tertian parasites. His temperature showed quotidian rises between 103° F. and 105° F. with relative bradycardia, but no rigors or chills. Treatment comprised oral and intramuscular quinine for the first two days, followed by oral and intramuscular mepacrine for the next three days. On the fifth evening, during defervescence in a profuse sweat, signs of cardiac weakness and drowsiness appeared, and adrenalin $\frac{m}{7}$ was given by injection. When referred for examination the next morning, the patient was in a state of extreme prostration as in a condition of shock, conscious but apathetic, silent and immobile, barely able to answer questions in a whisper. His skin was cold and clammy, his muscles flaccid. His temperature subnormal, and his pulse-rate 70 per minute with a poor volume and tension. Reduplication of the second cardiac sound was audible at the apex, and the blood-pressure was low (98/68). Laboratory reports: *Blood*: W.B.C. 8,800 per c.mm.; D.C.—P. 60 per cent, L. 40 per cent; R.B.C. $3\frac{3}{4}$ million per c.mm.; Hb. 84 per cent; B.S.R. 8 mm. per hour; W.R. and K.R. negative. *Urine*: Albumin, sugar, deposits, nil. *Fæces*: *Amœba* ova, cysts, cells nil. Energetic stimulant treatment for restoring cardiovascular activity (caffein, strychnine, camphor, brandy, glucose, etc.), with continuation of antimalarial therapy, produced a satisfactory response within forty-eight hours, followed by uninterrupted recovery.

NERVOUS EPISODES.

Various phenomena of nervous disturbance are frequently manifested in both benign and malignant malaria. Headache is one of the commonest of these symptoms, being an especially prominent feature during the hot stage of the fever. Mental confusion is not uncommon in the high fever of benign infections, while malignant cases show a distinct tendency towards restlessness and delirium. The association of hyperpyrexia with these symptoms, particularly in malignant infections, may be the prelude to cerebral malaria, the most pernicious and dangerous of the nervous episodes of malaria, which culminates in coma and severe depression of the vital functions, only too often ending fatally despite the most energetic treatment. Regional sporulation of malarial parasites in the neuraxis may cause a diversity of focal lesions, both paralytic and irritative, resulting in aphasic, apoplectiform, hemiplegic, bulbar, cerebellar, choreiform, tetaniform, epileptiform, Parkinsonian, and other neurological episodes that may lead to considerable diagnostic perplexities. The following case presents the features of an exceptionally interesting cerebral episode, with four hyperpyrexial crises of 109·6°, 105°, 107°, and 108° F., focal symptoms, prolonged coma, and the interesting observation that benign, and not malignant, parasites were detected in the patient's blood:

Case 4. Cerebral Malaria.—A Dutch Burgher sapper, aged 22, with no previous history of malaria, was sent to hospital from a malarious station on the sixth day of an intermittent fever, complaining of headache, anorexia, and constipation. He had a temperature of 103° F., and a pulse-rate of 110 per minute, with no other clinical abnormality and a negative blood smear for malaria. Symptomatic treatment with sodium salicylate, aspirin, phenacetin, and a soap enema was followed by a drop of the temperature and pulse to subnormal on the next morning. The fever reappeared during that afternoon and rose steadily throughout the night and the following morning. The blood was again negative for malaria, but as the fever continued to rise, with increasing headache, irritability, and restlessness, an intramuscular injection of quinine grains 15 was given. By noon, the temperature had risen to 105° F., with a pulse-rate of 116 per minute, aphasia, dysphagia, and increasing restlessness, which was soon followed by severe delirium. An injection of morphia grain $\frac{1}{4}$ allayed the cerebral symptoms, but the fever continued unabated, until it reached 109.6° F. in the axilla within about two hours. The patient was now deeply comatose, incontinent of urine and fæces, with Cheyne-Stokes respiration, flaccid muscles, extinct reflexes, and fixed, dilated pupils; his pulse was weak and running at about 140 per minute, his blood pressure had dropped to 88/58; a blood smear taken at this stage revealed benign tertian rings, amœboid forms, and schizonts, but no malignant forms could be found. No enlargement of the spleen or liver was palpable. Quinine grains 15 was promptly repeated by intramuscular injection, the intravenous route being considered too dangerous owing to the extreme hypotension. About 3 c.c. of hot, clear, cerebrospinal fluid, which was under normal tension, were withdrawn by lumbar puncture. Energetic cooling measures were applied—ice bags to the head and neck, ice massage and cold sponging of the body and limbs, iced saline by proctoclysis, fanning—while half-hourly records of the temperature and pulse were kept. Within one and a half hours the temperature had dropped over 7°, reaching 102° F., the lowest level for the day, but the pulse-rate remained at 140 per minute, with a poor volume and tension, and the patient continued in a comatose state. Within the next two hours, the temperature began to mount again, and this was accompanied by two epileptiform seizures, for which potassium bromide grains 60 and chloral hydrate grains 20 were administered rectally. The next febrile peak occurred a little past midnight, when the patient became restless and delirious with a temperature of 105° F., a weak, low-tensioned pulse of 130 per minute, and muscular twitchings in his limbs. Another blood smear taken at this stage again showed only benign and no malignant parasites. After another intramuscular injection of quinine and ice applications, the fever commenced to decline, and, with further quinine treatment, subsided to 99.8° F. during the afternoon. Despite defervescence, the pulse did not come down below 120 per minute and continued poor in volume and tension; injections of digitalin, strychnine, adrenalin, and nikethamide retarded the pulse-rate to 100 per minute. The patient was quiet, but still unconscious, his breathing was regular and easier, a perceptible return of his reflexes was observed, but his pupils remained dilated and immobile. With nightfall, the temperature and pulse-rate began to rise again till a third hyperpyrexial crisis was reached at 107° F., with a pulse-rate of 130 per minute, when intramuscular quinine, lumbar puncture, and intensive cooling measures were resumed. The response to this treatment was a short-lived subsidence of the fever to 104° F., after which it rose sharply, accompanied by a failing pulse and respiration. Cardiac stimulants, oxygen inhalation, glucose-saline by proctoclysis were added to the treatment, but with no response. The temperature continued to climb, reaching its fourth and final peak at 108° F., when fatal cardiac collapse supervened (fig. 1).

The profound degree of cerebral disturbance caused by the patient's first hyperpyrexial crisis was reflected by the persistent coma, pupillary paralysis, continuous hypotension, and the vagaries of the temperature-pulse relation, that were so prominent thereafter. At no stage of the fever, after that first crisis, was the blood-pressure adequate to justify intravenous quinine medication, while even intravenous saline infusions were rarely possible owing to the collapsed state of the superficial veins of the limbs.

If this patient had survived his illness he would, most probably, have

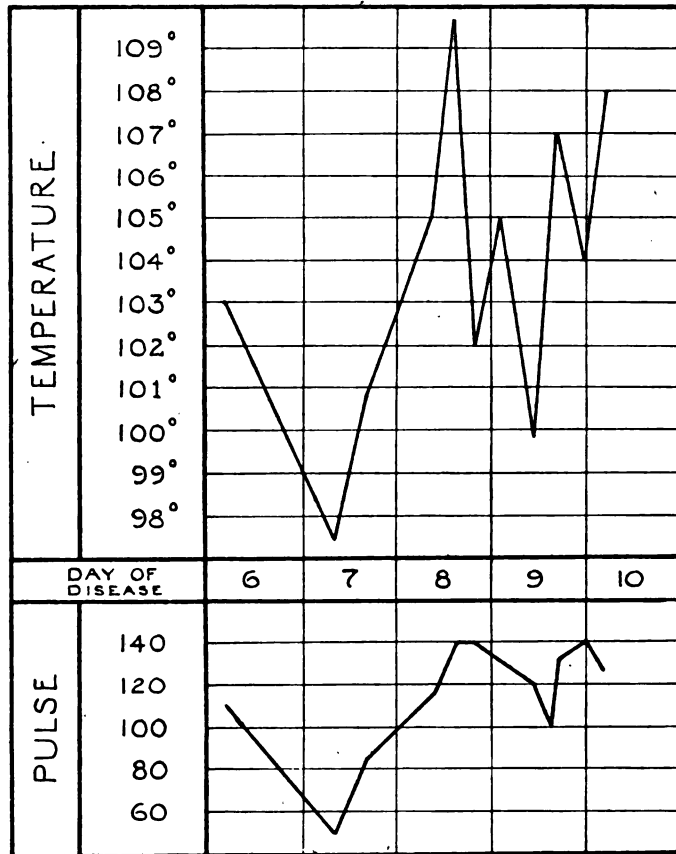


FIG. 1 (Case 4).—Cerebral malaria with hyperpyrexia.

suffered from life-long cerebral disability through the effects of the high temperatures to which his brain had been exposed. Recovery from cerebral malaria is sometimes rendered incomplete by irreversible changes in the brain due to factors other than hyperpyrexia pure and simple, e.g. as a result of capillary hæmorrhages or embolic lesions. Chronic encephalopathic states may, thus, present themselves as sequelæ of malaria, even despite prompt and efficient treatment, as the following case illustrates:—

Case 5. Malarial Encephalopathy.—A Tamil sapper, aged 24, while under treatment for his first attack of malaria, a malignant tertian infection, suddenly developed premonitory symptoms of cerebral involvement on the eighth day of his fever—headache, dysarthria, mental dullness and confusion. He rapidly passed into a state of coma lasting three days, during which his temperature remained elevated between 102° F. and 103° F. with his pulse-rate ranging between 100 and 130 per minute. The blood-pressure being low at first (90/75), quinine grains 20 was injected intramuscularly, with adrenalin $\frac{1}{15}$ and nikethamide 1 c.c. subcutaneously. As the blood-pressure rose to 100/80, intravenous quinine grains 6 in 20 c.c. of normal saline, was administered twice. During the comatose phase, the patient was fed by nasal tube and a continuous glucose-saline drip maintained rectally. After recovery of consciousness, he was treated with mepacrine orally, and remained apyrexial after the fifteenth day. But residual signs of cerebral dysfunction

persisted—aphasia, dysphagia, spastic paresis of the left lower limb, with mental dullness, lethargy, amnesia, and emotional incontinence (uncontrollable weeping and laughter). Blood examination showed a negative response to the Wassermann and Kahn reactions; the blood-pressure remained stationary at 108/80; the optic discs and fundi showed no abnormality. The patient was kept in hospital for a further period of two months, but as his encephalopathy showed no signs of improvement, he was invalided out of the Army.

The mental changes observed in the foregoing case reflect yet another aspect of the clinical activity of malaria. Mild, transient psychical disturbance, such as mind wandering, failure of concentration, confusion, amnesia, or apathy, is not uncommon in malaria. More rarely, cerebral malaria may introduce itself in the guise of some psychotic episode, such as maniacal delirium, severe melancholic or paranoid states, etc. Diagnostic errors are likely to arise when some familiar condition is stimulated, e.g. the alternation of confusion and memory loss, with delirious episodes, may be mistaken for alcoholic psychosis, especially in the presence of dysarthria, or of myalgic or neuritic symptoms; listlessness, drowsiness, or lethargy, occurring in a case of continuous or remittent malarial fever, with bradycardia, leucopenia, and a dry tongue, may readily suggest typhoid fever in the absence of serological tests.

It may not be out of place to refer, in passing, to the possibility of the reverse error, namely, ascribing to malaria a psychopathic state resulting from mepacrine toxicosis in susceptible persons. About 18 such cases have come under my observation among soldiers concerned in the present study, and 2 cases among private patients. The majority of these patients exhibited symptoms of a transient hypomania-psychomotor hyperactivity, exhilaration euphoria, lack of inhibition and intolerance of restraint, with frequent insomnia. A few patients were rambling and loquacious in conversation, with signs of disorientation, amnesia, and confusion. Two patients progressed to a state of acute mania, and had to be invalided out of the Army. All the rest recovered from their psychotic disorder within one to five weeks. In one of the private cases, the psychotic episode provoked by mepacrine appeared to have precipitated a schizophrenic reaction. Many of the patients who recovered were able to recall the salient features of their behaviour during the psychotic phase. Treatment consisted of immediate withdrawal of mepacrine where it was still being administered, and, at first, of diuretics, and laxatives to promote elimination of the drug through the urine and faeces, and sedatives and hypnotics as indicated. On the advice of Brigadier T. F. Rodger, Consulting Psychiatrist, ALFSEA, alkalis were withheld in the later cases owing to the risk of lowering (instead of increasing) the excretion of mepacrine, and ammonium chloride was administered instead. The change of treatment appeared to shorten the course of the psychosis in general, several patients becoming free of symptoms within a week of the onset. In one case, the resumption of mepacrine after subsidence of psychotic disturbance, resulted in recurrence of the symptoms, but in milder form, and of shorter duration, than in the original episode. The incidence of mepacrine encephalopathy as a complication of malaria has been extremely small in my experience—18 cases among about 10,000 soldiers

treated with mepacrine—and the condition may be considered as a very rare and relatively benign therapeutic accident which can easily be remedied.

While malarial episodes referred to the central nervous system are well recognized, peripheral nervous manifestations are conspicuously rare. Transient neuralgia is, perhaps, the commonest of such nervous symptoms, and is often associated with myalgia. There seems to be considerable difference of opinion as to whether malaria causes true peripheral neuritis. The neuritis that is sometimes a feature of malarial cachexia may bear explanation in terms of nutritional deficiency and avitaminosis. But the hyperæsthetic and paræsthetic sensations, as well as the paretic and myatrophic weakness, that occasionally supervenes for some time after malignant malaria may be expressions of a toxic neuritis. Such episodes most commonly affect the lower limbs, while brachial and facial neuritis, oculomotor and laryngeal palsies, and optic neuritis have been recorded. Malarial amblyopia can be distinguished from quinine amblyopia by the colour of the optic discs, which are bright pink in the former, and white in the latter. Though malarial neuritis is usually transient, it may be persistent or recurrent in an incompletely suppressed infection, as was the probable explanation in the following case, which occurred in a civilian patient who had suffered from several attacks (probably relapses) of malaria contracted during the great Ceylon epidemic of 1934:—

Case 6. Malarial Neuritis.—A Sinhalese schoolmaster, aged about 35, was referred to me about ten years ago, with a history of recurrent unilateral sciatica of several months' duration. The condition having proved intractable to diverse forms of treatment, both medicinal and physical, according to allopathic as well as ayurvedhic advice, the question of paravertebral injection of the sciatic nerve roots had come up for consideration. From the patient's point of view, the disability affected him through recurrent interference with his vocation, rather than through its severity.

Examination showed the usual symptoms of subacute sciatic neuritis: abolition of the ankle-jerk, hyperæsthesia, and wasting and flabbiness of the muscles of the leg. No evidence of focal sepsis, toxæmia, alcoholism, or avitaminosis could be established. Laboratory studies showed no evidence of abnormality in the urine or fæces, a mild degree of secondary anæmia with no leucocytic abnormality in the blood; and a negative Wassermann reaction. The spleen was palpably enlarged, but not markedly so.

Close inquiry into the history of the case disclosed the fact that the patient had experienced transient tingling and pain after one of his numerous attacks of malaria, the symptoms having affected the opposite upper limb, and that his first attack of sciatic had come on a short time after this episode. It also seemed evident that anti-malarial treatment had been inadequate and haphazard. In view of these facts, a careful search was recommended for evidence of latent malaria, and the blood, after several negative smears, showed the presence of quartan parasites.

An intensive course of quinine treatment orally and by intramuscular injection was advised. About three or four months later the patient's doctor reported that the sciatic symptoms had steadily subsided and completely disappeared, that the patient had improved considerably in general health, and that he was quite free from his disability.

ALIMENTARY EPISODES.

Anorexia, nausea, and vomiting are common concomitants of malarial paroxysms, and ordinarily call for no special attention. But, occasionally, these symptoms may assume a degree of severity that constitutes a pernicious episode. Vomiting may be profuse and distressing, accompanied by epigastric tenderness

and pain, and severe aching of the abdominal wall, but high fever is rare in these cases. Gastric episodes of this nature may be intermittent or continuous. Incessant hyperemesis, if uncontrolled, may produce hæmatemesis, dehydration, acidosis, exhaustion, and prostration, terminating in an algid episode. The only effective control of these gastric episodes is, of course, antimalarial therapy, which should be initiated parenterally. The gastric distress may be relieved by repeated lavage with iced alkaline solutions, followed by the oral administration of cerium oxalate grains 3, cocaine hydrochloride grain $\frac{1}{8}$, in pill or cachet; adrenalin hydrochloride m 10 to 20, or creosote m $\frac{1}{2}$, or chloretone grains 5 to 10, in crushed ice. After the gastric irritability has been controlled, quinine and mepacrine will, usually, be satisfactorily tolerated by the stomach.

Bilious vomiting with slight jaundice may occur in malignant malaria without producing much constitutional upset. Sometimes these symptoms may assume an intensity that produces the condition known as bilious remittent malaria. This episode usually comes on with severe nausea and increasing vomiting which rapidly becomes bile-stained, and may even become sanguineous. Epigastric tenderness becomes marked, and within a day or two jaundice is well established. The urine is frothy, dark, and contains bile pigment; the fæces show a heavy bile content, and bilious diarrhœa may occur; the blood shows the presence of bilirubin. If the liver becomes enlarged and tender, the patient begins to experience a sensation of discomfort and heaviness under his ribs. Although malarial jaundice is one of the pernicious episodes of malaria, it is not dangerous in itself, but through its pronounced tendency to produce rapid anæmia, asthenia, and toxæmia, it may predispose to fatal complications, as in the following case:—

Case 7. Malarial Jaundice.—A Malay Lance/Corporal, aged 30, with no previous history of malaria or jaundice, was admitted to hospital with quotidian fever and chills of nine days' duration. On admission, his sclerotics were icteric, his liver tender but not enlarged, and his spleen was not palpable; his blood was negative for malaria, and no evidence of bile was present in his urine. On the third day, severe nausea and hiccup caused much distress, for which intravenous glucose-saline, and subcutaneous morphia were given. The blood now showed a malignant tertian parasitæmia, and oral quinine was initiated. By the next morning, the patient was drowsy and vomiting profusely; his urine became scanty and showed the presence of bile pigment, bile salts, leucine and tyrosine; jaundice was increasing in intensity. Vomiting was allayed by repeated sips of adrenalin in iced water. Calcium gluconate in glucose-saline was given intravenously. By evening, bilious vomiting set in and oliguria became more evident. The blood showed a biphasic direct van den Bergh reaction with a positive indirect reaction. The urine was so dark as to suggest hæmoglobinuria, but spectroscopic and chemical analysis revealed that the coloration was due, not to hæmoglobin, but to a massive excretion of urobilin. Meanwhile, the general condition of the patient was rapidly deteriorating although the temperature did not reach 103° F. and quinine medication by intramuscular injection was maintained apart from the other treatment. Vomiting was becoming persistent and hiccup almost incessant, with rapidly deepening jaundice, progressive asthenia, and exhaustion. Finally, signs of cardio-respiratory failure heralded the onset of acute pulmonary œdema which terminated fatally within six hours. Malignant tertian parasites were present in the patient's blood almost up to the end.

Unfortunately, it was not possible to get permission from the patient's relations to make a post-mortem examination of the case, which might have

revealed interesting information about the liver, for correlation with such findings as tenderness of the organ without enlargement, persistent oliguria with the excretion of leucine and tyrosine, apart from bile products, urobilin, etc., which suggest some hepatic catastrophe in the nature of acute yellow atrophy of the liver.

Malaria generally exhibits no significant manifestation of intestinal disorder, and the fæces rarely show any abnormality apart from an increase of bile pigment. Diarrhœic episodes are, therefore, regarded as pernicious manifestations of malaria. Fortunately, simple malarial diarrhœa is usually readily amenable to antimalarial therapy, but when the condition complicates a debilitated case, it may induce a fatal termination, as in Case 9.

Some of these malarial episodes may closely resemble acute amœbic or bacillary dysentery. The isolation of malarial plasmodia from the fæces and intestinal exudate in such cases, comparable to the demonstration of amœbæ, ova, or cysts in amœbiasis, has been found possible by special technique. The dysenteric episode, even in benign tertian malaria, may arise with dramatic suddenness and rapidly cause death despite energetic treatment, as in the following case:—

Case 8. Malarial Dysentery.—A Sinhalese Lance/Corporal, aged 21, with no previous history of dysentery or malaria, was sent to hospital with fever and diarrhœa of a day's duration. He had a temperature of 100° F. with a pulse-rate of 80 per minute on admission. His tongue was clean and moist, no clinical abnormality was present in his heart, lungs, liver, or spleen. His stools were watery, but devoid of blood or mucus on inspection. The routine laboratory examinations were ordered and the patient was put to bed on an arrowroot diet. During the subsequent twenty-four hours his temperature rose to 101.2° F., and his pulse-rate to 100 per minute; the diarrhœa became more severe (20 stools a day) with severe griping, but not muco-sanguineous. The abdomen was soft but diffusely tender, and the liver and spleen remained unpalpable. Laboratory reports. *Blood:* Benign tertian rings and amœboid forms present; W.B.C. 3,400 per c.mm.; D.C.—P. 38 per cent, L. 50 per cent, M. 12 per cent. *Fæces:* Amœbæ, ova, cysts, nil. *Urine:* Albumin, sugar, deposits, nil. Treatment comprised quinine by intramuscular injection, calcium gluconate in glucose-saline by intravenous infusion, starch-opium enemata, an increased fluid intake, and glucose-brandy by mouth. As the diarrhœa continued unabated, stools being muco-sanguineous and passed half-hourly, tincture of opium and sulphaguanidine by mouth were added to the treatment during the evening of the second day. By the morning of the third day, the patient was severely dehydrated, with subnormal temperature, soft, running pulse, dry, furred tongue, but no abdominal rigidity or distension. Treatment was maintained, but the diarrhœa was uncontrollable. The rapidly failing circulation and respiration were treated with cardiac stimulants and oxygen inhalations, despite which the patient passed into an algid condition, and died within eighty hours of the onset of his illness.

The most dreaded, and happily the rarest, of the alimentary episodes in malaria are those severe malignant infections of the bowel which produce choleraic or choleriform phenomena. These episodes are characterized by profuse, almost incessant, diarrhœa, with pale watery, mucoid stools, which may sometimes be sanguineous; severe dehydration, often augmented by vomiting; oliguria, or anuria; agonizing muscular cramps; profound prostration, algidity, and coma. When such a pernicious episode develops independently of fever or other evidence of malaria, and pursues a rapid and virulent course, clinical

differentiation from true cholera may be impracticable, and, if uncontrolled, the patient may collapse and die from heart failure.

HÆMOGENIC EPISODES.

The diminution of red corpuscles in malaria is only partly due to the direct destructive effects of the parasites. Considerable numbers of erythrocytes, both parasitized and normal cells, undergo disintegration in the spleen. The malarial pigment, hæmozoin, is presumed to play a part in this blood destruction, perhaps by hæmolytic action, and by increasing capillary permeability and facilitating hæmorrhagic loss. This latter possibility would explain the purpuric and other hæmorrhagic episodes occasionally met with in malaria. The youngest red corpuscles and the reticulocytes are, generally, the most vulnerable of the blood cells to the malarial plasmodium, but cells of all ages are parasitized in malignant infections. When oligocythæmia is pronounced, degenerative changes, such as poikilocytosis, anisocytosis, or punctate basophilia, may be exhibited by the erythrocytes. The anæmia of malaria is hypochromic in type, both through loss of hæmoglobin from hæmolysed cells, and through a lowering of the hæmoglobin content of the surviving ones. A further factor in chronic malarial anæmia is a diminution in the blood volume. Erythrocyte counts of two or three million cells per c.mm., with hæmoglobin contents of 40 per cent. or 50 per cent., were commonly encountered among soldiers who had suffered from recurrent attacks of malaria. The following is presented as an example of an exceptionally severe anæmic episode resulting from chronic malaria:—

Case 9. Malarial Anæmia.—A Moor pioneer, aged 22, was admitted to hospital complaining of breathlessness, præcordial discomfort, progressive wasting and asthenia, of two months' duration. He had suffered from numerous attacks of malaria in an endemic locality of North-Western Ceylon before enlistment. Within the preceding year he had undergone treatment for benign tertian malaria and anæmia in two military hospitals: on the last occasion he had been placed on the danger list, and remained in hospital for three months.

The patient was emaciated, weighing 89 lb., and presented obvious indications of severe anæmia—palpitation, dyspnœa, and faintness on mild exertion; an earthy pallor of his skin, pearly white conjunctivæ, blanched nail-beds, a flabby, pale tongue; a hæmic systolic bruit audible over his præcordium; marked enlargement and tenderness of his spleen. Diagnosis was substantiated by laboratory reports: *Blood*: R.B.C. $\frac{1}{2}$ million per c.mm., Hb. 20 per cent; blood picture—anisocytosis, poikilocytosis, polychromasia, pessary forms present; W.B.C. 4,000 per c.mm., D.C.—P. 64 per cent, L. 29 per cent, M. 7 per cent; blood smear showed benign tertian parasites after repeated search. *Urine*: Albumin, sugar, bile, nil, urobilin present. *Fæces*: Amœbæ, ova, cysts, repeatedly nil. *Gastric analysis*: n.a.d.

Treatment comprised iron medication for the anæmia, supplemented with liver extract and arsenicals; a modified course of quinine and mepacrine for the malaria; minerals, vitamins, tonics, and appropriate dieting to improve the nutritional state; and symptomatic treatment as required.

The initial response to treatment was satisfactory—the patient's weight rose to 94½ lb. in the first month, with a rise of his erythrocyte count from $\frac{1}{2}$ million to 2 million cells per c.mm., and of his hæmoglobin content from 20 per cent to 45 per cent. Progress was retarded during the second month by frequent nausea and anorexia, which interfered with medication and feeding. Recurrence of alimentary complications during the third month was followed by a setback, with deterioration of the blood to its original

condition; this was remedied by repeated small blood transfusions. Further progress was dramatically cut short by the unfortunate onset of a severe, intractable diarrhoea, which rapidly induced an algid state with emaciation, dehydration, cardiovascular asthenia, prostration, and fatal collapse.

Patients who do not tolerate oral medication with iron owing to gastric irritability and intestinal upsets, or those who do not appear to absorb iron from medicinal preparations, often readily assimilate iron from vegetable foods. The ayurvedhic physicians of Ceylon depend mainly upon a ferruginous vegetable diet in their treatment of anæmia, and of the herbs and shrubs utilized by them for this purpose, the leaves of *Hydrocotyle asiatica* and *Sesbania grandiflora* are two of the richest local sources of iron; the former is a little creeping herb with violet-like foliage, that has enjoyed from time immemorial a reputation for manifold medicinal virtues: the latter is a leguminous shrub whose white succulent flowers are considered a delicacy when lightly cooked. A diet rich in these two vegetables was the principal means of combating the extreme anæmia in another malarial patient, who was so gravely ill that the mere act of turning him on his side was sufficient to induce cardiac distress and dyspnœa. His condition was even worse than that of the last-mentioned patient, for he was quite unable to tolerate quinine or iron by mouth. With intramuscular quinine and a diet rich in the two vegetables referred to, this patient made a remarkable recovery from what seemed, at first, to be an impending fatal anæmia.

The white blood corpuscles exhibit an interesting numerical oscillation in malaria. During apyrexial intervals there is a relative leucopenia with an increase of large hyaline mononuclear leucocytes. As a paroxysm comes on, more white cells appear in the blood, producing a moderate leucocytosis, while the mononuclears diminish rapidly with the rise of temperature and reappear with defervescence. A leucocytic count of 3,000 to 4,000 cells per c.mm., with a mononucleosis of 10 per cent to 15 per cent during afebrile intervals is considered pathognomonic of malaria. Both the mononuclear and the polynuclear leucocytes sometimes show pigmentation due to phagocytic ingestion of hæmoglobin, or malarial pigment derived from disintegration of plasmodia and erythrocytes. The following interesting malarial episode is presented as a reminder that malaria may adopt a guise with a remarkable superficial semblance to typhoid fever:—

Case 10. Malarial Leucopenia.—A Sinhalese Lance/Corporal, aged 35, who had received his T.A.B. inoculations a few months previously, and who had experienced two attacks of malaria, was in hospital with a remittent fever which continued above 100° F., a slow pulse of 74 to 80 per minute, headache, thirst, a dry, furred tongue, with tenderness and enlargement of the liver and spleen. Blood examination showed no malarial parasites in two successive smears, and the Widal, Wassermann and Kahn reactions were negative. Blood-counts showed: W.B.C. 1,800 per c.mm.; D.C.—P. 19 per cent, L. 63 per cent, M. 11 per cent, E. 7 per cent; R.B.C. $3\frac{3}{4}$ million per c.mm.; Hb. 75 per cent. A third blood smear was examined and malignant tertian rings were seen. Blood culture reports were all negative, while the urine, fæces, and sputum disclosed no abnormality.

The patient was put on a routine course of antimalarial therapy (quinine grains 30 for two days, mepacrine 0.3 gramme for five days, followed after a two-day interval by pamaquin 0.03 gramme for five days). During the first few days a pleural rub was audible

over the left lung base, and a catarrhal laryngitis appeared a few days later; these complications responded to treatment without affecting the clinical course of the case to any appreciable extent. By the fourth day of mepacrine treatment the fever was controlled, and the patient began to feel comparatively well.

But, despite attempts to raise the leucocytic content of the blood by protein injections, etc., the leucopenia remained between 1,800 and 2,400 per c.mm., with transient rises to 2,600, 2,800, and 3,600 per c.mm. during febrile paroxysms occurring in the first ten days. After completion of the antimalarial treatment, the leucocytic count showed a

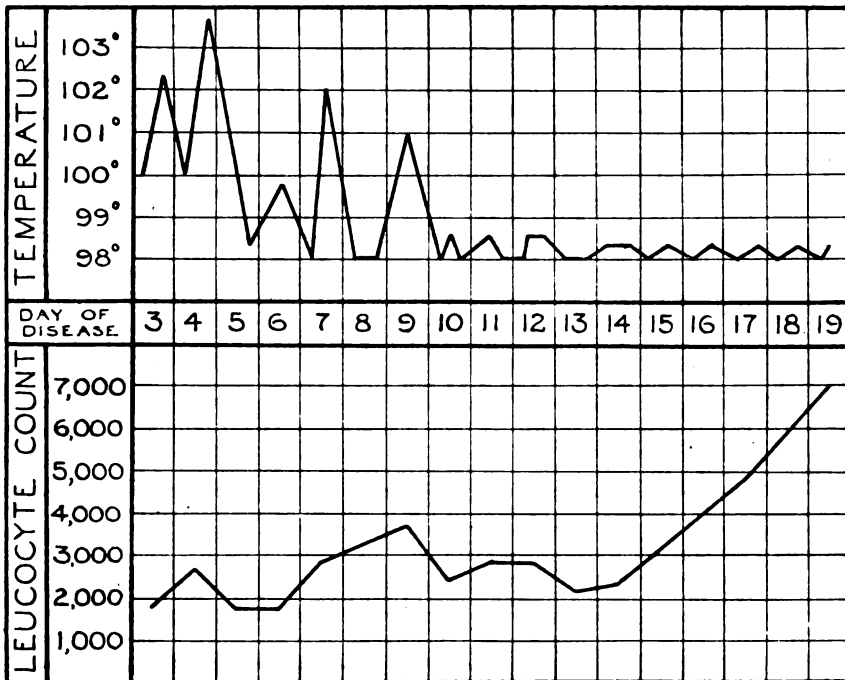


FIG. 2 (Case 10).—Malignant malaria with leucopenia.

steady rise, reaching 7,000 per c.mm. by the nineteenth day (fig. 2), after which the patient was discharged from hospital. Subsequent re-examination of the blood after varying intervals during about a year revealed no abnormality whatever.

RENAL EPISODES.

The remarkable upheavals caused by the malarial parasite in the blood of its victims provide a notion of the factors that determine certain renal episodes in malaria. Polyuria is common during the malarial rigor, when the frequent passing of large quantities of pale urine indicate increased renal secretion during this stage. As the fever rises, the urine darkens in colour and diminishes in quantity, while with diaphoresis and defervescence it becomes scanty and high-coloured. During the cold stage there is an increased secretion of urea, chlorides, sulphates, and carbonates, with a diminution of phosphates. With the onset of the hot stage, the output of urea and carbonates progressively declines, while an increased secretion of phosphates occurs during the sweating stage. Transient urobilinuria, usually subsiding with defervescence, is very common in malarial paroxysms. Massive urobilinuria may impart a dark sherry

tint to the urine, and, in the presence of bile pigments, may even simulate the urine of blackwater fever (Case 7). Urobilinuria is a reflection of the degree of intravascular hæmolysis caused by the malarial plasmodium; the liberated hæmoglobin, is transformed in the reticulo-endothelial system into hæmosiderin and bilirubin, the latter being excreted as urobilin in the urine, as well as in the bile; the latter phenomenon, when exhibited in excess, accounts for the icteroid and bilious episodes of malaria.

When intravascular hæmolysis becomes too rapid and intensive for the reticulo-endothelial tissues to cope with the resulting massive hæmoglobinæmia, the excess of hæmoglobin over the renal threshold leaks out through the kidneys and appears in the urine as oxyhæmoglobin, methæmoglobin, and acid hæmatin, producing the phenomenon of blackwater fever. The exact pathogenesis of this form of hæmoglobinuria remains obscure, but the condition appears to be some mysterious malarial episode in which, perhaps, a metabolic dyscrasia conditioned by the plasmodium, and probably also related to quinine, releases some hæmolysin which disintegrates the erythrocytes and then splits up the liberated hæmoglobin. Various theories advanced to explain the causation of blackwater fever have been recently reviewed by Skipper and Haine (1945).

The only instance of this episode in the present series occurred in a patient under observation in hospital, who had apparently contracted the disease in a hyperendemic locality, made a satisfactory recovery, and later developed permanent renal damage:—

Case 11. Malarial Hæmoglobinuria.—A Sinhalese pioneer, aged 23, had completed a routine course of treatment for malignant tertian malaria. He had received quinine grains 90, mepacrine 1.5 grammes, and pamaquin 0.15 gramme, remained afebrile throughout the treatment, and was awaiting discharge from hospital.

He was a native of a malarious village in North-Western Ceylon, and during two years' service in hyperendemic jungle districts of North Central Ceylon with the Pioneer Corps, he had suffered from malaria six times. While on pilgrimage to a Buddhist shrine in Southern Ceylon, six weeks before admission to hospital, he had spent a night in a notorious blackwater fever zone.

On the day he was due for discharge from hospital, the patient suddenly fell ill, complaining of malaise, headache, nausea, vomiting, constipation, and aching in his loins. He had a temperature of 99.8° F., a pulse-rate of 100 per minute, with a sallow complexion, icteroid sclerotics, furred tongue, and a soft abdomen with tenderness over both kidneys. The urine revealed no abnormality apart from urobilin, amorphous phosphates, and a few epithelial cells, but by evening it became reddish, turning darker in colour during the night, with dysuria and increasing pain in the loins.

When referred for examination the next morning, the patient complained of exacerbation of all his symptoms, with profuse sweating, bilious vomiting, and severe aching over his renal, splenic, and suprapubic regions, which were extremely tender on palpation. His temperature was 99.4° F., pulse-rate 100 per minute, tongue dry and thickly coated, icterus marked, liver and spleen not palpable though tender. The urine, when freshly passed, appeared opaque and as black as stout, with a brown froth, but, on standing, separated into a clear, blood-red supernatant liquid, and a thick, opaque, blackish-brown sediment; it was neutral to litmus, and had a specific gravity of 1026, a heavy albuminous precipitate, positive reactions to the benzedrine and guaiacum tests for blood, no bile or water-soluble colouring matter; microscopical examination revealed no erythrocytes, but epithelial cells, pus cells, and granular casts were recognized amid a mass of cellular

debris and phosphatic crystals; spectroscopic analysis showed the characteristic bands of methæmoglobin and, after reduction, of oxyhæmoglobin. Blood examination showed a scanty parasitæmia (one malignant tertian ring in every two fields); marked secondary anæmia (R.B.C. $2\frac{1}{4}$ million per c.mm., Hb. 50 per cent; a moderate leucocytosis (W.B.C. 10,500 per c.mm., D.C.—P. 62 per cent, L. 34 per cent, M. 4 per cent); a negative direct reaction and a biphasic indirect reaction to the van den Bergh test. Records of the blood-urea concentration are, unfortunately, not available.

Treatment was directed towards increasing the secretion and alkalinizing the reaction of the urine, controlling the malarial infection, and giving symptomatic relief. Strict rest in bed was ensured, and a special nursing orderly detailed for the case. The fluid intake and urine output were charted, the former being maintained at 10 pints per day by oral and intravenous administration: frequent drinks of sweetened citrus juice, small feeds of milk three-hourly, intravenous drip of 3 per cent sodium citrate in a pint of glucose-saline twice daily, etc. A mixture containing grains 30 each of sodium bicarbonate and potassium citrate was given four-hourly. Mepacrine 0.2 gramme was given orally thrice daily. Radiant heat was applied to the loins. Following a rigor with vomiting, dysuria, and oliguria, in the afternoon, the temperature rose to 103.4° F., with a low-tensioned pulse of 130 per minute. The patient became very apprehensive and alarmed about his condition, the gravity of which became evident to him in the light of his previous malarial experiences, which had been relatively uneventful. Injections of nikethamide 1 c.c. subcutaneously, and mepacrine hydrochloride 0.375 gramme intramuscularly produced a satisfactory clinical response, allaying the patient's anxiety. A similar episode recurred in twenty-four hours. The urine was then alkaline, with a specific gravity of 1020, less darkly coloured, still albuminous, and with the same deposits as before. The liver and spleen showed palpable enlargement for the first time, forty-eight hours after the onset of the blackwater episode. The blood showed a parasite count of one malignant ring in every three fields and an increase in the anæmia (R.B.C. $1\frac{1}{2}$ million per c.mm., Hb. 45 per cent). Thereafter, the case showed steady progress in response to the treatment: mepacrine was continued orally for five days, by when the fever subsided; the urine was kept alkaline for a week, by which time the discoloration and albuminuria had cleared up, and the specific gravity was normal; the anæmia responded to iron, liver, and feeding. The patient was discharged from hospital thirty-six days after admission for malaria, and twenty days after the onset of his blackwater fever.

About two months later, this patient was referred again with asthenia, albuminuria, and œdema of his feet. Rest in bed and treatment for about a month was ineffective in controlling the albuminuria, and the patient was recommended for invaliding out of the Army on account of his renal defect.

Although albuminuria is said to be frequently noted in malaria in quantities exceeding a trace, particularly in quartan infections, the foregoing case was one of the very few instances in the present series where any albumin at all was found in the urine. The association of albuminuria and œdema with a reduction of serum-albumin is generally interpreted in terms of nephrosis rather than nephritis. Such a renal reaction may be induced by the irritative activity of malarial toxins, and, if prolonged, a nephrosis may, apparently, be the starting point of degenerative changes leading to chronic nephritis, either of the parenchymatous type or of the interstitial type. The application of this hypothesis, which postulates such a sequence of pathological reactions in the kidneys, would serve to provide a satisfactory explanation of the ultimate renal damage observed in the last case.

PULMONARY EPISODES.

A mild initial bronchitis associated with coryza is not uncommon in malaria, especially in malignant tertian infections. This may, occasionally, be the pre-

lude to a bronchiolitis or a bronchopneumonia, and less frequently to a lobar pneumonia. The diversity of features manifested in the pneumonic episodes of malaria would seem to imply the existence of a variable pathogenesis. Certain cases of malarial bronchiolitis and bronchopneumonia exhibit a perceptible periodicity that is suggestive of a direct relation with plasmodial activity. While some cases of pneumonitis are associated with a marked degree of leucocytosis, little or no leucocytic disturbance can be demonstrated in others. Of practical interest is the observation that, while some cases of malarial pneumonia are readily amenable to chemotherapy with sulpha compounds, there are others that resist control by such treatment but show a remarkable response to quinine and mepacrine medication. Most of the disappointing results in our treatment of the earlier cases of malarial pneumonia in this series, including

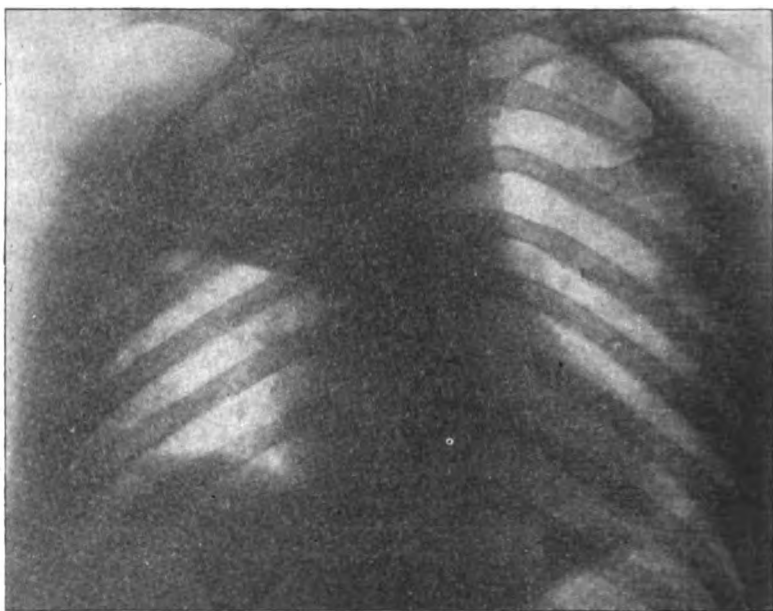


FIG. 3 (Case 12).—Malignant malaria with pneumonia.

among them a few fatalities, would appear, in the light of subsequent experience, to have been due to undue reliance on the antipneumonic virtues of sulpha therapy with insufficient antimalarial medication. Pneumonic episodes in malaria, if controlled by effective treatment according to the indications of the individual case, rarely give rise to any morbidity. The same may be said of the average pleural complications in malaria, as is illustrated in Case 10. But a protracted malarial pleurisy with a persistent effusion may lead to indefinitely prolonged ill-health: in a few cases where this happened in the present series, the patients had to be invalided out of the Army, after months of ineffective treatment in hospital, owing to chronic pleural thickening and diminution of respiratory efficiency.

The following case illustrates some of the observations referred to above:—

Case 12. Malarial Pneumonia.—A Sinhalese gunner, aged 23, who had suffered from malaria five years before, was admitted with fever, chills, rigors, and cough. For the first four days his temperature remained elevated between 102° and 105° F., with the pulse-rate varying between 90 and 120 per minute; but no abnormality was found in the spleen, lungs, or heart, the blood was negative for malaria and showed—W.B.C. 6,200 per c.mm. D.C.—P. 76 per cent, L. 29 per cent, E. 1 per cent; and the sputum was negative for tubercle bacilli. Quinine grains 10 t.d.s. was commenced. On the fifth day, clinical signs of apical pneumonia appeared in the right lung, subsequently confirmed by radiological appearances of uniform consolidation of the entire upper lobe of the lung (fig. 3). The appearance of malignant parasites in the blood at this stage substantiated the clinical diagnosis of malaria. Quinine medication was supplemented with sulphapyridine, vitamin C, antiphlogistine plasters, etc. The patient's condition became so grave within thirty-six hours with restlessness and other toxic signs, that he was placed on the danger list. It was decided to withhold sulphapyridine and intensify quinine therapy; during the next twenty-four hours the patient was given parenteral quinine in two intravenous doses of grains 6 each and one intramuscular dose of grains 15. This was followed by a dramatic fall of temperature to subnormal, with a marked improvement in the general and pulmonary condition. Continuation of oral quinine, followed by mepacrine, completed the resolution of the pneumonia, and recovery was uninterrupted thereafter.

During the acute phase of this patient's illness, his blood-pressure varied between 104/74 and 118/80, while the leucocyte count was remarkably constant between 6,000 and 6,800 cells per c.mm., arising to 8,800 per c.mm. when the patient was quite afebrile and his lungs almost clear.

SPLenic EPISODES.

The spleen being the principal seat of plasmodial activity, signs and symptoms referable to this organ are of special significance in malaria. The absence of splenic enlargement or tenderness cannot, however, be held to exclude the disease at any stage. Rarely does the primary attack of malaria produce clinical signs of splenic involvement until the fever has lasted for about a fortnight. The degree of parasitæmia bears no constant relation to the size of the spleen; though a large spleen may be evident with a moderate parasite count, a heavy parasitæmia need not necessarily be associated with pronounced splenomegaly.

Acute splenitis is an implication of excessive plasmodial activity. The organ becomes congested, tense and painful, and palpation may elicit extreme degrees of tenderness. Prompt therapeutic control of the infection is generally followed by subsidence of the acute splenic episode. But if clinical activity be protracted, or if the infection remains latent, some degree of chronic enlargement may persist in the spleen.

Chronic splenomegaly is the result of fibrotic changes in the organ caused by repeated attacks of malaria. This may be the result of recurrent infections or of relapses due to inadequate treatment. Occasionally, one encounters cases where the most energetic antimalarial therapy fails to control the disease; the only example of such an episode in this series was recorded in a Ceylonese medical orderly who had numerous relapses of malaria, showing both benign and malignant parasites in his blood, despite vigorous treatment with quinine and mepacrine, both orally and by injection, pamaquin, and the Ascoli technique: the case was observed through a period of sixteen months, and the patient was invalided out of the Army with his parasitæmia uncontrolled, though he was physically not severely affected by the prolonged infection.

Although fairly large spleens were frequently seen among Ceylonese soldiers who had developed chronic malaria, the really striking cases of splenomegaly that came under my observation occurred among East African and Indian troops. Some of these patients gave histories of chronic malaria lasting over periods of from three to six years, and most of them had probably suffered from malignant infections. One specially remarkable case, in an African soldier, presented an unforgettable picture of severe malarial cachexia, with advanced secondary anaemia, marked cardiovascular asthenia, and a huge, hard spleen extending for about three fingerbreadths below the umbilicus and resulting in a protuberant abdomen which contrasted strangely with the extreme emaciation of the rest of his body.

The clinical cameos here described are but reflections of a few facets of the many-sided clinical picture of malaria. They serve to emphasize the polymorphic activity of the malarial plasmodium, which seems to be able to evoke with ease symptoms of almost unlimited range and variety. When we contrast the simplicity of the common malarial paroxysm with the complexity of fulminating episodes associated with grave disturbance of bodily function, sometimes with lethal effect, there seems to be no analogy between this disease and any other. Some of these pernicious episodes, as, for example, hepatitis, pneumonitis, or hæmoglobinuria, are as yet imperfectly understood. Are they coincidental complications, or may they be specific malarial phenomena? Until the pathogenesis of these still obscure manifestations is established, it may not seem unjustifiable to include them under the designation of malarial episodes.

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UNUSUAL ASPECTS AND THERAPY IN AMŒBIC DYSENTERY

BY

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THIS paper is an account of amœbic dysentery in Ps.o.War taken by the Japanese—British, Australian, American and Non-Asiatic Dutch East Indian Army personnel. The experiences of the writer were gained in Malaya and Thailand.

The amœbic dysentery reached epidemic form. How much was of epidemic severity and how much due to the attendant circumstances of Prisoner of War life will later be discussed. Amœbic dysentery was shown in all its forms and in forms little seen, if ever, in peacetime conditions. Its behaviour without drugs and in its really acute form may add a page to the literature on this subject which may be of use—certainly it will probably never again fall to any writer to see so many cases, with so little facilities for studying and combating the disease.

EPIDEMIOLOGY AND ÆTIOLOGY.

On the capitulation of Singapore all British and Australian Troops were sent to the former military area of Changi.

Changi, normally, had buildings for some 3,000 men with their wives and families. Up to 6,000 were in the area at its most crowded periods.

Into this area went some 50,000 prisoners. The hygiene and sanitary conditions in Changi prior to capitulation were excellent. Amongst the troops in Malaya the only important diseases were venereal disease and malaria, the latter only contracted in the outlying island forts and some camps up-country. Occasional cases of amœbic dysentery and more rarely still, bacillary dysentery, were seen, and very occasionally typhus, cerebrospinal meningitis and enteric and diphtheria.

Infectious diseases amongst the civil native population were limited to typhus, enteric, malaria and venereal disease. Amœbic dysentery and more rarely bacillary dysentery were not seen frequently.

Changi as an entirely military area was even more favoured and its sanitation was excellent. Local natives were few and the only malaria was at the coastal and outer forts. The anti-malarial situation in the cantonment and for some distance around was excellent. The water supply was good and the sewage disposal by septic tanks adequate.

Just before capitulation Changi had been very badly bombed and mortared, the pumping station crippled and later purposely destroyed and the greater majority of the buildings damaged.

It was to this semi-derelict area that a defeated and weary Army was sent, marching the fifteen miles from Singapore in the heat of the day. Those that could crowded into buildings, those that could not, into shacks, tents, etc.

Many carried the germs of disease from the campaign up-country, many from the appalling conditions of the last days of Singapore—where all civil services including burial of the dead had broken down and the water had been cut off.

These men finding no sanitation and no water supply, dispirited and caring little, performed amazing feats of sanitary indiscretion before our medical services which were allowed to continue functioning were able to take charge.

Proper bore-hole and deep trench latrines were dug, chlorination of water commenced and general sanitation was attempted by using sea water for flushing building W.C.s. But the damage was done.

Bacillary dysentery which was just commencing during the last days of Singapore broke out in real earnest. An attempt to start a dysentery hospital was in the main successful but the Japanese decided to centralize *all* sick in one small barrack area, thus disseminating the dysentery and infecting the rest of the new hospital. After appalling conditions for a few weeks in this hospital permission was given to form a separate dysentery wing. To this wing the writer went in charge of the laboratory. In a few weeks there were 1,200 dysentery beds all full.

The first amœbic case appeared soon after the writer opened this laboratory and the disease continued at a steady rate of approximately eleven fresh cases per week for eight months. In short, just what might have been expected in the conditions prevailing, but quite different from what subsequently occurred. The bacillary dysentery did not abate till after November.

This may be said to be the genesis of the amœbic dysentery outbreak. We now pass to the aggravating factors.

Whilst a few troops went to Singapore, Saigon and the Japanese Empire as working parties the great bulk remained in Changi for eight months. As a punishment for "taking up arms against the Japanese" the rations issued for the first six months of captivity apart from being Asiatic were reduced to an outrageous scale, each man getting: Rice 8 oz., tea $\frac{1}{6}$ oz., sugar $\frac{2}{3}$ oz., milk $\frac{1}{2}$ oz., salt $\frac{1}{6}$ oz., butter $\frac{1}{6}$ oz., flour 2 oz., cheese $\frac{1}{2}$ oz., vegetables 1 oz.—DAILY.

After a protest the ration was raised in ten days' time to: Rice 16 oz., sugar $\frac{3}{4}$ oz., tea $\frac{1}{5}$ oz., salt $\frac{1}{6}$ oz., fruit $\frac{1}{3}$ oz., milk $\frac{19}{24}$ oz., M. & V. $\frac{17}{24}$ oz. (from our own captured stocks!), Ghee $\frac{5}{24}$ oz., flour $1\frac{1}{2}$ oz., fresh meat $1\frac{1}{4}$ oz.

This ration scale lasted with minor alterations and variations till August 16 when a certain amount of Red Cross stores were allowed in via Diplomatic Repatriation Ships.

It will be seen that apart from its low caloric value this ration scale was lamentably low in fats, vit. A, B, and C—especially so in B.

Except for a small "amenity grant" of a few cents a day which started in June no pay was issued except to those working in Singapore until August 16. Then Officers were given 30 dollars a month. Hence except for those who had money and could buy "black market" food smuggled in at outrageous prices, no extra food could be obtained except coconuts. When the amenity grant started peanuts and an occasional egg could be added.

Men suffered considerably from the climate—an endurable one only in civilized conditions. Damp, muggy, and often with torrential rain. In spite of the presence of the sea, bathing was severely restricted after the first few days and even washing of clothes was infrequent. No fans or ice were available and little or no light at night, except in the hospital after September, when electric lights and some fans were mended and connected up to the Singapore power. Owing to the limited sanitary arrangements flies were a nuisance and with the cessation of malaria control, mosquitoes commenced their attentions.

The "Punishment Period" officially ended on August 16 with the departure of our General Officers to the Japanese Empire. Conditions were slightly ameliorated, pay as mentioned, light in the hospital, better entertainment facilities and the arrival of some Red Cross supplies. These were, however, only a prelude to the general exodus to the Thai-Burma Railway.

In addition there occurred during the first few days of September an incident which greatly reduced general health and increased the spread of disease, though paradoxically increasing morale. This incident now famous under the name of the "Selarang Tea Party" consisted in the herding into a space comprised by a Barrack Block for 800 men and a Parade Ground, of 17,000 men. This was the penalty for refusal to sign a parole not to try and escape. A further threat to move the 3,000 bedded hospital (including dysenteries) into this space also, led to the men having to give in—the Japanese however were forced to concede and put it on record that the parole was under duress—which of course rendered it non-binding—but they failed to appreciate this. Incidentally the punishment for attempted escape being death, generally bayoneting, there was little incentive to try it. Nevertheless holding out to this degree did a lot to restore morale and instilled into our enemies an unwilling respect.

The overcrowding, wetting and general strain of a tense situation did a lot of harm to general health besides encouraging the propagation of disease. The writer was present and can vouch that conditions baffled description—men crowding the buildings, roofs and Barrack Square—the centre of which had perforce to be dug into a vast open latrine.

During the period February to November with these factors in operation it is little wonder that disease had its inevitable way. Besides bacillary and amœbic dysentery already mentioned we had slowly increasing malaria and a few cases of scrub typhus. But the great fear of the physicians was soon to be realized—deficiency diseases. There is some disagreement as to the exact genesis of this and here it is discussed briefly.

B, Deficiency.—The very first cases noted were a selection of peripheral neuritis patients; at first they appeared to be beriberi, with absent knee-jerks. glove and stocking anæsthesia, hyperæsthesia of calves and paralysis. But as they appeared in men whose habits either admitted or suggested a high alcoholic intake, viz. planters, old soldiers who had risen to commissioned rank via the Quartermaster route, or remained Quartermaster Sergeants or Warrant Officers, and persons who were known to be heavy drinkers (as opposed to drunkards, in case the above statement should give rise to a wrong impression). it can be fairly

safely assumed that the cases were alcoholic neuritis, especially as a B₁ deficiency encourages the onset of this.

Beriberi itself followed soon after, viz. in about three and a half months from capitulation. The neuritic form was seen first and later the cardiac and wet type. This is to be distinguished from nutritional œdema which also made its appearance about this time. Beriberi was also seen as encephalopathy, death following definite mental signs, loss of memory, wanderings, etc., and with a post-mortem picture of Wernicke's sign (hæmorrhages into the corpora mamillaria). Cases of retrobulbar neuritis were also seen.

B₁ Deficiency.—Pellagra next showed itself, with sore tongue, angular stomatitis, skin rashes aggravated by the sun, aching feet and in the worst cases, diarrhœa, mental symptoms and spastic paraplegia.

B₂ Deficiency.—Aribo flavinosis appeared at the same time, characterized by red, dry itchy scrota, later becoming weeping and raw. These were originally thought to be B₁, but nicotinic acid and its derivatives did not help, whereas riboflavine administration did, thereby fixing the condition as B₂ and B₁ deficiency.

A Deficiency.—Although corneal ulceration and xerophthalmia commenced to appear at the end of the Changi period and also in Thailand, one must consider that it was present somewhat earlier as evidenced by the total lack of resistance to bacillary dysentery, and also to diphtheria which attacked the troops in August. Several cases of night blindness were noted in a mild form.

C Deficiency.—Scurvy did not occur, nor did it occur in Thailand or Changi throughout the internment period—sufficient vegetables luckily were always available.

D Deficiency.—Needless to say with the tropical sun this was absent.

E Deficiency.—There was no means of determining this, but it is generally agreed that any impotence or sterility amongst returned prisoners of war is of psychiatric rather than dietetic origin.

Apart from avitaminosis and the dysenteries the remaining diseases in Changi were malaria, diphtheria and skin diseases. *Malaria* gradually increased *pari passu* with the cessation of malarial control outside the camp but it did not present a serious picture in the first nine months and quinine and atebrin was still plentiful. *Diphtheria* was seen occasionally in Changi before the Japanese occupation chiefly amongst children, but spasmodic cases commenced to appear amongst the troops immediately after capitulation. The disease reached epidemic form in August, 1942. Many severe cases were noted with many deaths. Antitoxin was hard to obtain and stocks scanty. In addition laboratory facilities were very limited and cultural examination could only be undertaken in the Australian section laboratory. Even then, proper Loeffler's medium was not available, an egg medium being substituted when eggs could be obtained. Consequently diagnosis was unreliable and many doubtful cases occurred. Skin diphtheria occurred, especially on the weeping scrota of B₂ deficiency, the heat and sticky serious exudate making no doubt an excellent medium for *Corynebacteria*. Skin disease was brought on inevitably by difficulty in washing and laundering and by vermin and sweating.

At the end of the month of October, 1942, came the great move of prisoners to Thailand. Conditions in Thailand were unknown and the nature of the work to be undertaken, if any, unknown. Food was heard to be plentiful in Thailand, which was true up to a point as will be seen later. Consequently it was not known exactly whom to send and whom not—unfortunately many men were sent totally unfit for the conditions. Indeed the whole prisoner population had undermined constitutions from the events laid down above. Also, owing to calls for more men, many post-amœbics without sufficient clearance tests were sent up; this may on first sight appear carelessness on the part of the medical authorities at Changi but it must be remembered that many thought this move merely a security one and that specially prepared camps and hospitals would be provided. Men continued going up-country until May, 1943, and others came from Java, Sumatra and other Dutch East Indian islands, including many Dutch and Dutch Eurasians.

The railway journey was appalling—five days in the train, 25 to 31 men being crowded into metal goods wagons without room to stand or lie down. Those that went by sea had an even worse time. On these journeys old dysenteries relapsed, sanitation was completely absent and conditions may be imagined.

Thus came to Thailand an already debilitated force after a most arduous journey, to find torrents of rain and the most primitive accommodation provided—Coolie huts of the worst type—no hospitals—no comfort of any description; the only bright spot was the food which was plentiful and nourishing.

The writer arrived as Pathologist with the Base Hospital Staff—a very limited laboratory staff and equipment accompanied him.

It was then learned that the work was the building of a railway from Bangkok to Burma (Moulmein) through virgin jungle.

The base hospital was to serve all the troops up the river along which the line was to be built—this hospital was only begun in November and was designed for 1,200 beds—if wooden platforms can be styled beds. Our captors evidently imagined our sick would not be more: it is difficult to understand how any organization could make such a gross underestimation. It is, however, now known that Dr. Saito responsible for these medical arrangements has been arraigned as a War Criminal.

As men arrived they were taken by barge, lorry and lastly on foot straight up-country—the nourishing food of the Thailand hinterland was not to be theirs for long.

History will tell of the sufferings of these men and the mortality, 1 in every 3½, speaks for itself. Conditions up the river were appalling: as this was pioneer work men had to march through jungle and camp in the open, often in torrential rain and in the winter months considerable cold. Floods, difficulty of transport, etc., prevented a steady supply of food and men were often for days on rice, pumpkin and water. The work was hard, especially to a debilitated population, and increasing numbers fell sick. Their places had to be taken at once as the railway had to go on. More men were constantly being sent up including Tamils from Malaya—even so the work lagged and even sick men had to work.

Evacuation of serious sick was terribly difficult—the worst cases generally dying on the way. Drugs up-country were almost non-existent and doctors and orderlies few and far between.

The Base Hospital soon became full and quasi-hospitals sprang up everywhere—some becoming bigger than the Base hospital itself. The Base hospital had most of the drugs sent up but even that was a totally inadequate amount. The other hospitals had even less. In addition sick got separated from their own “groups”—which were the Japanese system of accounting for prisoners—and were constantly being shifted from place to place to rejoin their respective “group” hospitals quite without consideration of their condition.

The railway was finished in August, 1943. Not till January, 1944, however, was a really big hospital started for the accommodation of the victims of the railway and it was not completed until July, 1944. This was the Allied P.O.W. Hospital, Nakorn-Paton, near Bangkok and it cleared sick from Thailand and Burma. By the time it was fully functioning the original need for it had ceased, viz. the cause—the building of the railway.

Conditions were improving, the dead were dead and could not be brought to life, so that this hospital was more concerned with the relicts.

The diseases prevalent in Thailand were as follows:—

BACILLARY DYSENTERY which was present at the commencement and which tended to burn itself out, very little being left after the first few months.

— AMOEBIC DYSENTERY accounted for more deaths than any other disease, either alone or complicated. In addition to the ever-increasing case incidence of amoebic dysentery originating in Malaya and augmented by infection picked up from dirty water supply, dirty conditions, lack of sanitation, flies, native food purchased as extras, etc., etc., etc., there occurred a definite epidemic in at least one known locality, Konju, which spread throughout the entire prisoner population. It appears to have originated in this camp from an itinerant barge or barges run by Thais or Chinese, which sold food to the prisoners. The cases directly from this source were of a very virulent variety, out of all resemblance to generally accepted standards even of acute amoebic dysentery.

BERIBERI appeared again, both the dry and wet types and also Shoshin, or acute cardiac beriberi.

NUTRITIONAL ŒDEMA was frequently confused with wet beriberi and the two of them with pellagra, all three being common.

PELLAGRA was characterized by typical glossitis and stomatitis, burning or aching feet, increased knee-jerks, œdema, diarrhoea and in some cases spastic paraplegia. Little dementia was seen.

B₂ DEFICIENCY in the form of scrotal dermatitis was rife.

EYE DISEASES were common, ulceration and night blindness from A deficiency, retrobulbar neuritis from B₁ deficiency and blurred vision from B₂ deficiency.

DIPHTHERIA, both faucial, labial and cutaneous, was common.

TROPICAL ULCERS of the most appalling size were common, some 500 amputations being done. The ætiology of these is obscure but it is assumed that there must be a bacterial or virus causation aggravated by A deficiency.

Finally there was CHOLERA—worst in June-September, 1943. Inoculation against this disease by the Japanese had been only half-heartedly carried out.

This somewhat lengthy preamble serves to show the epidemiology and ætiology of amœbic dysentery amongst P.o.W.s, together with the conditions complicating symptoms and treatment of the disease.

The infection would seem to have occurred in several ways and from several sources. Those who came into camp with the disease contracted in the campaign—a small number. Those who picked up the disease from the unhygienic conditions in Singapore at the capitulation and in the early days of Changi. Spread of the disease in P.o.W. life from those already with it. From infection in the dreadful conditions in Thailand, with the outbreak of a major mass infective epidemic at Konju. The presence of large numbers of Dutch Eurasian troops who are known to have a high carrier rate—about 25 per cent. Lastly one must not forget that a certain proportion of inhabitants of the U.K. and U.S.A. carry cysts. Yorks and Smith, working amongst Army recruits, give this figure from 5 to 19 per cent. Wenyon in Egypt found British soldiers had a carrier rate of 11 per cent. Pauson found New York food handlers to have a 4 to 5 per cent rate. Australia, however, has no cyst carriers *per se*.

Although most of these cyst carriers in European countries are reckoned to be harmless, Westphal considers that an infection of the bowel may light up these amœbæ. With the bacillary dysentery epidemic in Changi this could certainly have happened. There is, however, still considerable doubt as to the varying degrees of pathogenicity of strains of *entamœba histolytica*.

Brumpt maintains there are virulent and non-virulent strains. Certainly later in this thesis will be shown that there are very wide responses in different patients to infection with *entamœba histolytica*.

Suffice it to say that the causes of this epidemic may be tabulated as:—

- (1) Carriers—especially Dutch Eurasians.
- (2) Local infection due to bad sanitary conditions.
- (3) A mass food borne epidemic at Konju.
- (4) Possibly Westphal's phenomenon.

This study was commenced first in Changi purely from the microscopic angle and mainly as a differential diagnosis from bacillary dysentery. In the Thailand Base Hospital at Kanchanburi (or Kanburi) the writer had charge both of the laboratory and the dysentery wards. Here the study of the disease at its worst was undertaken and treatment mainly without emetine attempted. Later, from June, 1944, onwards, the writer was in charge of the dysentery wing of the Allied Prisoner of War Hospital, Nakom-Paton, some 1,200 beds in the dysentery wing alone. Here the residue of the amœbic dysentery epidemic were housed, i.e. those who had not died or been cured and who had in the main passed into the chronic or carrier states. They were kept here more or less in sanctuary—but unfortunately near the end of the war the Japanese started cutting down the hospital beds and sending out carriers and chronics, making the final round up of amœbics at the end of the war extremely difficult.

Most of the cases were Europeans, Americans and Australians but some were

Eurasian Dutch in whom amœbic dysentery is a common and not much feared disease and in whom the ætiology was somewhat different.

One hundred and forty cases treated with no emetine or with under 6 grains were studied in Kanchanburi as well as considerable numbers before the emetine gave out or when some appeared. In addition the writer had 300 cases at Nakom-Paton as well as the administrative charge of the block of 1,200.

Nothing in this thesis suggests any alterations to the preconceived ideas of the causal organism or its ætiology—the particular factors in this epidemic fitting in with what is already generally known. It is considered, however, highly possible that there is a difference in virulence between certain *Entamœba histolyticæ*—a classification as yet not accepted.

SYMPTOMATOLOGY.

Several distinctive types are noted:—

- (1) The acute fulminating type.
- (2) Severe infections which in most cases died if emetine was not given.
- (3) Cases pushed over the summit to a chronic stage by various drugs, and which remained in this stage or ultimately reached the carrier state or in a few cases were cured.
- (4) Mild cases. Some of these could be cured without emetine.

The Acute Fulminating Case.—Although most authorities speak of acute and chronic forms, the existence of fulminating cases is rarely given prominence. Osler in the 13th Edition of his "Practice of Medicine" refers to "acute cases." Manson-Bahr in "Tropical Diseases" states that acute cases are rare—he himself only having seen three which he would call acute. Some of the cases seen in Thailand would have needed immediate and full courses of emetine and its compounds if a cure was to have been effected and life saved and even then the issue might well have been in doubt.

The incubation period would appear to be short—ten days to a fortnight. The disease comes on briskly and in a few days the patient is passing many stools a day. The patient then goes downhill with considerable rapidity and dies within seven to ten days of onset. The last days are truly terrible as nothing touches the dysentery and in a few cases where a grain or so of emetine was obtained to alleviate suffering, no effect was noted at all. Stools reached 40 a day in numerous cases and the diagnostic point that amœbic dysentery can be distinguished from bacillary by the frequency of stools *per diem* here fails completely. These facts, the violence of the symptoms and frequency of stools were noted by many others including Street and Vardy at Tarsao, Thailand, and are at variance with established ideas.

Great pain and tenesmus accompanied the motions and excoriation from acid stools added greatly to the patients misery. Intolerable pain was complained of from distension especially over the cæcum. In the last few days nausea followed by incessant vomiting occurred and the cases resembled cholera in many respects, except that they were conscious and very violent, often hurling themselves around the hut spurting fæces and vomit in their agony—such

a description being in no way an exaggeration. The writer has never seen it described elsewhere.

Stools were typical, starting with fæcal matter mixed with blood and passing on to the so-called "anchovy sauce" stool. These progressed to sloughs from the bowel and pure blood, the fæcal matter naturally getting less and less. There was no resemblance to the odourless blood and clear mucus of bacillary dysentery even where the stools were 30 to 40 a day. The odour was typical and highly unpleasant. Finally only a very short time before death the patient became comatose and presented all the signs of acute dehydration—wrinkled fingers, dry tongue—shrivelled, shrunken, mummified appearance, with well-marked hippocratic facies before expiring.

Severe Type.—This type may start with a severe bout of dysentery with slight fever, 20 to 30 stools a day, tenesmus and pain and may be thought to be of bacillary nature until stools are examined both naked-eye and microscopically. Far more commonly the case starts with slight diarrhœa or bouts of diarrhœa alternating with normal or constipated periods. The condition gradually gets worse or the attacks more frequent until the patient seeks medical advice or, alternatively, seeks medical advice as he has "seen blood." Generally the stool picture was found to be that of soft diarrhœic motions with blood and brown fæcal fluid and semi-solid material intermixed. Sometimes the stools were solid or semi-solid but streaked with blood. In other cases the stools were just watery diarrhœa. In all cases the motions were offensive and the great majority acid causing excoriation and pain when being voided. Without emetine these cases with a few exceptions, which will be described later under treatment, proceeded on a downward path slowly but surely, some took months to finally die and experienced temporary amelioration during this downward path from time to time—a particularly distressing aspect from a psychological point of view, both for patient and clinician. Each attack, however, proved more severe, the stools increasing and the frank "anchovy sauce" type being seen. Later, as in the fulminating type, sloughs appeared. Considerable blood loss occurred in these cases, the patients becoming dehydrated, anæmic and emaciated. Irritating foods such as sauces, peanuts, vegetables and beans provoked severe bouts and pain was almost constant. This pain was increased by great distension of the bowel, with extreme discomfort and in many cases masses appeared in the cæcum due to intense thickening of the bowel from the amœbiasis.

With shortage of equipment and staff it was not possible to carry out blood-counts or blood-pressures on these patients except where definitely indicated.

Gastric symptoms were severe and distressing, vomiting, heart-burn, and anorexia being prominent.

Intense dry mouth and frequently hæmorrhoids added to the patients general misery.

Anuria and oliguria caused great pain and discomfort. A frantic desire to pass water led to nothing. Catheterization not only failed to find urine in the bladder but increased the pain and discomfort.

Hiccoughing was a late phase and always heralded death. The writer has

never known a case developing hiccoughs in the late stages recover. "Black-outs" and periods of unconsciousness supervened on these symptoms and the patients gradually sank into states of extreme pain, misery and wretchedness before finally dying.

The violent convulsions, copious vomiting and maniacal symptoms noted in the first type were, however, entirely absent.

In the cases observed at Kanchanburi, no equipment or facilities for post-mortems were available. No buildings could be used, the hospital being too crowded and cramped. Occasionally the surgeon performed a partial post-mortem on the operating table. This was out of the question for dysentery patients. However, at Nakom-Paton, such facilities were available and for a considerable time were used until the Japanese unaccountably suddenly forbade all autopsies.

The post-mortem appearances in these acute and severe cases were typical. The whole lower bowel could be a mass of undermined ulcers with only small areas of healthy tissue remaining, the appearance being black and necrotic with large sloughs. More often the condition was confined to three areas—cæcum, splenic flexure and sigmoid-rectum with considerable healthy areas between. Around these affected areas great thickening of the bowel occurred, but the plum-coloured swelling distended bowel of bacillary dysentery was quite distinct and could never be confused. The writer saw many of the latter at Changi. The greenish colour and the pseudo-membrane of bacillary dysentery with the characteristic hollows and ridges crowned with exudate makes a distinct picture from these amœbic cases.

Many of the amœbic ulcers seen were deep, penetrating far into the musculature. The bowel, however, was not thinned out as in bacillary dysentery, rather it thickened in step with the development of ulceration.

Perforation of amœbic cases was extremely rare—the writer only seeing one clinical case.

Cases are quoted of spread of amœbic infection to the lower small intestine. This is very rare and the line of demarkation seen at autopsy is distinct and striking.

Both sigmoidoscopy and proctoscopy were impossible at Kanchanburi but the latter was carried out at Nakom-Paton. Severe ulceration could often be seen right down to the external sphincter. The ulceration was characteristic, the undermined edges of the craters being demonstrable. Many of the ulcers were pin-point and quite distinct from bacillary. Surrounding inflammation was often absent and exudate non-existent. Often the ulcers involved the internal sphincter. The painlessness of the ulcers to the touch *per rectum* was noteworthy; the pain of amœbic dysentery would appear rather to be due (1) to distension, (2) to the acidity of the stool. In bacillary dysentery this is reversed—apart from soreness due to repeated evacuations, the condition is relatively painless—the ulcers are, however, sore to the touch *per rectum*.

The Chronic Type.—Many cases of the preceding type as a result of medication with drugs available other than emetine managed to survive long enough to obtain a degree of resistance enabling them to pass into the chronic stage.

In this condition patients remained, some ultimately becoming symptom free of their own accord, others carrying on until emetine became available and others remaining stationary.

Of the last, two chief variants were noticed: (1) Those with a consistent diarrhoea from 3 to 5 motions a day—sometimes passing *Entamœbæ histolyticæ* or cysts—more often not of considerable interest in these cases was the part played by secondary infection and by a pellagrous condition. When such drugs were available this could generally be easily decided by the effects of sulphaguanidine or nicotinic acid. Nevertheless a distinct number could be said to be entirely of amœbic origin. (2) The more typical chronic amœbic—days of comparative health with increase of bodily condition, amounting almost to obesity, broken at intervals with acute relapses with all the typical signs of pain, tenemus, “anchovy sauce” stools, the finding of active *Entamœbæ histolyticæ* and/or cysts. These relapses as a whole tended in time to become more infrequent. The care of these cases was one of the greatest difficulty under the existing conditions. To keep them in hospital was difficult in view of their apparently robust appearance in the quiescent periods: it was almost impossible to convince the Japanese of their ailments; if one did manage to retain them because of “infectivity” hospital working parties beloved of our captors invariably claimed them—furthermore, these working parties were liable overnight to be considered outside working parties and discharged forthwith. It was a noteworthy feature of the condition that the patient in a relapse lost all semblance of health and well-being almost within forty-eight hours.

The Mild Case.—A considerable number of these cases commenced and remained mild. There were cases in this series who were cured without emetine although in the majority these alternative drugs merely had an alleviating effect, and possibly prevented the disease becoming more serious. Furthermore, large numbers of these cases without any treatment at all appeared to remain in the same stage or quietly cleared up to reach the carrier condition.

They were a constant problem—to keep them in hospital was difficult, both by their looks and the apparent injustice to other patients needing the bed space or being needed for working parties; to send them out risked aggravating the disease and spreading the infection in the insanitary P.O.W. Camps.

The protection of these cases proved a long and weary struggle, by no means always successful.

The mild case ranged from occasional sharp bouts of typical amœbic dysentery to slight abdominal and gastric discomfort with occasional looseness of stools. Very often the diarrhoea was so slight and infrequent that the patient did not trouble to report it and the condition was found in a routine examination. Occasionally the only reason for reporting sick was “seeing blood.” Not infrequently the patient reported because of piles and the condition was only discovered then. Completely symptomless passers of *Entamœba histolytica* vegetative forms was sometimes seen and when one descended to this level the differentiation between a “carrier” and a “case” became a matter of difficulty.

The following is an illustrative case:—

Pte. E.—Argyle and Sutherland Highlanders—had several attacks of amœbic dysentery in 1940, 1941 in Malaya and again in Changi P.o.W. Camp, Spring, 1942. On 20.5.43 he was admitted to Kanchanburi Base Hospital. No emetine was available and various substitutes were tried. He had no diarrhœa and no symptoms after 7.6.43 yet active *Entamœbæ histolyticæ* in large quantities were found in his stools on 5.7.43 and were still present on his transfer to another camp in November, 1943—still symptom free.

During the last year of captivity the cases in Nakom-Paton Hospital consisted to a very great extent of chronics and mild cases which had survived up to date with improvised treatment. Emetine was available in small quantities sufficient to preserve life. New cases of course occurred but sufficient emetine was available to keep them alive or in mild cases to cure, consequently the types observed were almost entirely 3 and 4.

To be continued.

THE PARACHUTE FIELD AMBULANCE¹

BY

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A.D.M.S. H.Q. Palestine and Transjordan.

"Every officer and soldier, whatever his rank or arm of the Service, needs to be a skilled infantry fighter because that is the sum total of the value of each individual, no more and no less, in the opening moments of an airborne assault."

(Major-General E. L. BOLS, C.B., D.S.O.,
Commander 6 Airborne Division).

INTRODUCTION.

(1) The parachute field ambulance is a comparatively new unit and its special features are not well known outside the Airborne Forces. In addition, little has been committed to paper on the subject and those officers with most experience have now left the Army.

[The Parachute Field Ambulance as described by Lieutenant-Colonel Young, was composed of four elements. In the case of the Normandy operations, for example, these were disposed as follows: (a) Base details which remained in England. (b) The parachute element. (c) The glider element. (d) The "sea tail," i.e. transport, etc., which crossed with the Division attacking to join up with the Parachute Division. When an effective junction was made the "sea tail" joined up with the parachute and glider elements.—ED.]

(2) The first parachute field ambulance (16 Parachute Field Ambulance) was formed on April 6, 1942, and since then, parachute field ambulances have dropped into action in Tunisia (16 Parachute Field Ambulance), Sicily (16 Parachute Field Ambulance), France (224, 225 and 127 Parachute Field Ambulances), Holland (16 and 133 Parachute Field Ambulances), Germany (224 and 225 Parachute Field Ambulances), and Greece (127 Parachute Field Ambulance). They have also been used in a ground role in all these countries as well as in Italy (16, 127 and 133 Parachute Field Ambulances), Belgium (224 and 225 Parachute Field Ambulances) and Burma (80 Indian Parachute Field Ambulance).

[The following is an addition to the original paper—

It should be pointed out that the views expressed in this paper are the result of wartime experience and that, since the end of the war, the War Establishment of both a British airborne division and a parachute field ambulance have been changed. During the war an airborne division consisted of two parachute brigades and an airlanding brigade, a parachute field ambulance being attached to each parachute brigade. In 1946, the airlanding brigade was replaced by a third parachute brigade, thus providing three parachute field ambulances in each airborne division.

¹This paper was awarded the Leishman Memorial Prize for 1946.—ED.

In April, 1947, the War Establishment of a parachute field ambulance became the same as that of an infantry division field ambulance and separate field surgical teams (parachute) were formed on the scale of two for each parachute field ambulance.

It is of interest to add that, although an airborne division possessed an airborne field hygiene section during the war, there never was an airborne field dressing station.]

OBJECT.

(3) The object of this paper is to consider the parachute field ambulance from the selection of its personnel to their deployment in battle, with special reference to points of difference between it and the infantry division field ambulance.

METHOD.

(4) The subject will be considered under the following main headings:—

- (a) Selection of personnel.
- (b) The War Establishment.
- (c) Training of personnel.
- (d) Administration at the Base.
- (e) Operational preparations.
- (f) Operational deployment.
- (g) Consideration of A.F. I.1248 and A.F. G.1098 equipment.
- (h) Conclusions.

SELECTION OF PERSONNEL.

(5) All R.A.M.C. personnel in a parachute field ambulance are qualified parachutists: All parachutists in the Army are Volunteers. These two facts show at once that the personnel problem is difficult compared with the infantry division field ambulance. Few men want to be in the Army in general, let alone in paratroops in particular.

(6) The medical standards of fitness required for parachute duties, laid down in A.C.I.s and War Office letters, are higher than those necessary for infantry of the line. But, in addition to physical standards, an indefinable mental outlook is also necessary; there is, in fact, a "parachute type." It has been said that the most successful parachutists, officers and men, have been mild cases of anxiety neurosis. At any rate it will be appreciated that possession of nervous energy above the normal is a considerable factor in the mental make up.

Lastly, as a point of interest, some of the most successful paratroop officers have been quite unfit according to the laid-down physical standards, e.g. one of the most capable and courageous battalion commanders of the war required a special parachute and did only operational jumps because he had marked osteoarthritis of both knees—as well as chronic bronchitis. There was also the staff officer with one leg who still continued to parachute and who went across the Rhine in a glider.

(7) In selecting personnel it is essential to remember that the right man volunteers because of his individualism. Airborne Forces always had their

own psychiatrists (all qualified parachutists) during the war and they were a tremendous help at the selection stage. Parachute training is an expensive item financially and it is most important to recognize men who are likely to refuse to jump before completing the initial training or afterwards. Refusal to jump after qualifying as a parachutist is a Court Martial offence.

(8) The following are a few of the points to be on the look-out for:—

(a) It is well to try and elicit a man's reason for volunteering. It is important that his womenfolk know what he is doing. If they object to his action he is a possible potential refusal. A paratroop C.O. spends much time writing to anxious, and often threatening, wives and mothers.

(b) The man who has just been jilted or who is involved in third party domestic trouble is best avoided. It is all too common when investigating refusals to jump to hear of "woman trouble" dating back to pre-parachuting days.

(c) A frequent type is the man who has volunteered purely and simply to get out of his previous unit. A.F. B 122 is a useful guide on these occasions although long crime sheets, except for those showing offences of an insubordinate nature, are not grounds *per se* for turning a man down.

(d) Personal vanity is possibly the main reason for most people volunteering to jump although few will admit it. The vain man usually fits in quite well because he submits to the doctrine that he belongs to a Corps d'Elite and will do everything in his power to maintain that status. But the film star type of vanity must be rejected at once; the man with the "pencil-line" moustache and the one who uses perfume are untrustworthy and usually break down quickly under operational strain. The loud-mouthed "line-shooter" should be dismissed without further ado.

(e) During the war it was not uncommon to find a man volunteering for purposes of revenge; the enemy had destroyed his family and his home and he wanted to get his own back. Most men in this category did well and the elaborate care they came to exercise on enemy wounded was quite astonishing.

(f) Lastly, when men are being interviewed all they are thinking about is parachuting—they want to be paratroopers and the fact that they may be nursing orderlies is well in the background. Nothing is more fatal than to coax a man to go parachuting because he is a clerk or an O.R.A. It is better to have a humble G.D.O. or N.O. III as a qualified parachutist, who can be trained as a specialist after he has passed the "jump happy" stage, than to be faced by the refusals of coaxed specialists and key men.

(9) All the foregoing points apply equally well to officers but an officer should have pronounced *leadership* qualities before he is accepted. Napoleon used to ask of his officer-to-be "Is he lucky?" Luck is a most useful factor on parachute operations; by listening patiently to an officer's past history a lucky streak can sometimes be recognized and so turned to good advantage.

(10) There is a consolation to all this selection—by serving for a long time with paratroops an extra sense develops which enables one to choose the "type" on sight with reasonable accuracy.

THE WAR ESTABLISHMENT.

(11) The original 1942 War Establishment was based on the light field ambulance, as were the A.F. G 1098 tables.

The present War Establishment, dated June, 1945, is the third to be produced.

(12) It will be seen that the parachute field ambulance is a smaller unit than the infantry division field ambulance but that it is a specialized unit, having the necessary personnel for two surgical teams, compared with the latter.

Reference has already been made to the light field ambulance being its "foster-mother" and this, in a way, reveals the deployment of the unit in a ground role. However, the parachute field ambulance possesses very much more equipment than either the light field ambulance or the infantry division field ambulance, and comparison of the transport scales of these three units shows a relatively fewer number of vehicles, especially load-carrying ones, in the parachute field ambulance:—

			<i>Lt.</i>	<i>Para.</i>
		<i>Fd. Amb.</i>	<i>Fd. Amb.</i>	<i>Fd. Amb.</i>
Motor cycles, solo 350 c.c.	.. ..	9	14	—
Motor cycles, solo 500 c.c.	.. ..	—	—	12
Motor cycles, solo 125 c.c. (lt. wt.)	.. ..	—	—	3
Cars, 4 seater 4 × 4	.. ..	1	1	2
Cars, 5 cwt. 4 × 4	.. ..	5	6	8
Truck, 15 cwt. 4 × 4 G.S.	.. ..	4	1	2
Truck, 15 cwt. 4 × 4 water	.. ..	1	1	1
Lorries, 3 ton 4 × 4 G.S...	.. ..	12	13	7
Ambulances, 2 stretcher 4 × 4	.. ..	8	12	2
Ambulances, 4 stretcher 4 × 4	.. ..	6	6	8
Trailer, 1 ton G.S...	.. ..	1	—	—
Trailer, 10 cwt. 2 wheeled lt. wt. G.S.	.. ..	—	—	6
Trailer, 2 wheeled lt. wt. water 200 gall.	.. ..	—	—	2

(13) Before considering personnel in detail it is necessary to point out three further major features:—

(a) A parachute battalion has one officer and eighteen other ranks R.A.M.C. on its War Establishment and there are *no* regimental stretcher-bearers. The usual deployment is to have one Cpl. and three Ptes. with each company and the Sjt. and one Pte. at battalion H.Q. with the R.M.O.

(b) A parachute brigade H.Q. has a medical officer on its War Establishment.

Thus in a parachute brigade group there are four officers and fifty-four other ranks R.A.M.C. in addition to the field ambulance and therefore the number of R.A.M.C. personnel per brigade is considerably greater in a parachute brigade than in any other brigade group.

(c) All ranks in the parachute field ambulance are armed, the R.A.M.C. having automatic pistols.

14. The parachute field ambulance consists of a H.Q. and four sections giving a total of 182 all ranks. In addition to this there are first-line reinforcements, one officer and nineteen other ranks, who are attached to and train with the unit at the Base.

(15) The detail of the breakdown of the unit is as follows:—

(a) H.Q.: (i) 6 officers (C.O., 2 i/c, 2 surgeons, anaesthetist and QM.)
R.A.M.C.

(ii) 35 other ranks R.A.M.C.

(b) 4 Sections:—each 1 officer and 19 other ranks R.A.M.C.

(c) Attached

personal: (i) R.E. — 1 Spr.
(ii) R.A.S.C. — 1 officer and 51 other ranks.
(iii) A.D. Corps — 1 officer and 1 other rank.
(iv) A.P.T.C. — 1 other rank.
(v) A.C.C. — 5 other ranks.

(16) It is now worth while examining the other rank personnel in H.Q., especially those employed on purely surgical duties. These are as follows:—

1 Sgt. N.O.
3 L/Cpls. O.R.A.
3 Ptes. O.R.A.
6 Ptes. N.O.
5 Ptes. S.B.
1 Pte. Masseur.

This provides little more than the bare outline of two surgical teams (each team usually has three O.R.A.s, three N.O.s and one S.B.). Personnel must be available for resuscitation and post-operative nursing in addition to the other departments in a field ambulance H.Q. The immediate answer is to incorporate Section 4 in H.Q. and train this section in post-operative nursing, blood transfusion and resuscitation. But even then sufficient personnel are not available to run an efficient M.D.S. (NOT A.D.S. as in the infantry and armoured divisions) and it will be necessary to draw on Sections 1, 2 and 3.

(17) Having considered the surgical staff along general lines, it is now proposed to consider the administrative staff.

(a) Clerks: An additional clerk is essential in the field ambulance office and can conveniently be taken from Section 4 (N.B. each section has its own clerk).

(b) QM. Stores: The staff allotted on the War Establishment is too small and a ration N.C.O. and an additional storeman are necessary. The latter is found by taking one of the five H.Q. S.B.s and employing him part-time as storeman and batman to the QM. A second H.Q. S.B. is already in the QM. Stores as a shoemaker.

(c) Batmen: There are three whole-time batmen on the War Establishment and it is best to allot them to the C.O., 2 i/c and R.S.M. respectively. The QM., as has been shown, has a H.Q. S.B. as a part-time batman. The G.D.O. in each section is batman to the section officer. The transport officer uses his driver as a batman-driver. The S.B. in each surgical team is batman to the surgeon and anaesthetist of the team, the anaesthetist in the second team being the dental officer.

(d) Officers' Mess: On the War Establishment there is one A.C.C. cook, and, of course there are the two whole-time batmen of the C.O. and 2 i/c

respectively. It is not advisable to employ the C.O.'s batman as N.C.O. of the Mess because he must be well trained in fieldcraft and as a runner. An N.C.O. usually local acting unpaid, must therefore be found from the sections.

(e) Serjeants' Mess: On the original War Establishment an A.C.C. cook was allotted to the Serjeants' Mess then, for some inexplicable reason he was cut out of the new War Establishment. The Mess must obviously have a cook and this can be done by using the fifth, and last, H.Q. S.B. This gives the Mess the R.S.M.'s batman and a cook.

(f) Miscellaneous: Personnel are necessary to run the sports store, the unit canteen and the question of forming a small "I" Section might be considered.

(g) Fortunately Sections 1, 2 and 3 can easily be reduced in strength without resultant loss in efficiency and if this is realized at the outset many administrative worries will never appear.

TRAINING OF PERSONNEL.

(18) All field ambulances have certain training features in common and before listing the cardinal points in training a parachute field ambulance it must be understood that, whereas in an infantry division field ambulance lip-service is often paid to subjects like fieldcraft, such an attitude to training would be fatal in a parachute field ambulance. The parachute field ambulance commander must always have the following points uppermost in his mind when formulating his training policy:—

(a) All those under his command are *individuals* and he must therefore ensure that all ranks are thrown together as much as possible and get to know each other's temperamental make-up really well.

(b) He commands a unit of *parachutists* and that *physical fitness* is of prime importance. The A.P.T.C. Sjt/Instr. must have every access to him and always enjoy his confidence about doubtful personnel.

(c) On operations his unit will drop *by day* and *by night* right into *enemy* territory and therefore *fieldcraft*, *map reading*, *direction finding* by the stars and, if necessary, *self-defence* must be taught.

(d) The success of his unit will depend entirely upon the *leadership* qualities of himself, and his officers and N.C.O.s.

(e) Most of the officers and N.C.O.s he will have will be young (the top age limit for parachuting is at present 32 years) and inexperienced, both regimentally and administratively, and he will therefore have to organize *officers'* and N.C.O.s' *cadre classes*.

(f) Because of the very nature of a parachute operation he will have casualties and he must strive to make all ranks capable of doing more than one job, i.e., aim at *versatility*.

(g) Then, and then only, can he consider R.A.M.C. training.

(19) The medical training of a parachute field ambulance has become progressively more difficult for the following reasons:—

(a) In 1942, at the time when only one parachute field ambulance was in existence, it was possible to reject personnel not up to the N.O. II standard.

(b) In 1943 it was impossible to maintain four parachute field ambulances

with R.A.M.C., other ranks and conscientious objectors were voluntarily transferred from the N.C.C. to make up the deficiencies. Each of the two parachute field ambulances in 6 Airborne Division which went to Normandy in 1944 was one-third composed of conscientious objectors. These men were excellent in battle but could not, of course, be promoted, and this led to more difficulties than ever.

(c) In 1945 recruiting from the N.C.C. stopped and recourse had to be taken to voluntary transfers from the The Parachute Regiment. At the time of writing approximately 60 per cent of R.A.M.C. other ranks in parachute field ambulances belong to this latter category.

From the foregoing facts it will be appreciated that R.A.M.C. training has to start from the very beginning, be intensive, and produce quick results. A two months' intensive training programme proved most successful as a basis for the D-Day landings in Normandy.

(20) During initial training it is well to recognize that the men have a distinct aversion to wearing R.A.M.C. cap badges and shoulder titles—they much prefer the Parachute Regiment insignia and frequently wear them when on leave—but, after one battle they emerge R.A.M.C. "proud" and never look back. The lesson here is not to keep harping on "The Corps" during training; forced *esprit de corps* has only a negative value.

(21) With all these difficulties which have been so far encountered it is clear that the system of recruiting has not been taken sufficiently seriously. During the war there was possibly not sufficient time, but this year the passing of recruits from The Parachute Regiment I.T.C. to the R.A.M.C. Depot for basic R.A.M.C. training has been less successful than the wartime procedure. There would appear to be two solutions: (a) A parachute company at the R.A.M.C. Depot or (b) a continuation of the wartime system.

There can be little doubt that the first alternative is the ideal but to be successful it would require most careful organizing.

(22) In a parachute field ambulance everything revolves round the two surgical teams and the fact that, during the initial stages of a parachute operation, there is no evacuation to L of C medical units. Training priorities on the medical side are therefore going to be associated with the operating theatre and the resuscitation and nursing departments.

(23) Technical training of the surgical teams can only be carried out efficiently in a large general hospital. It is of no avail attaching the odd O.R.A. to this hospital here and that hospital there: the surgical team must be a team in every sense of the word. The likes and dislikes of each individual surgeon must be known before an operation in order to save the maximum life.

(24) Section 4, instead of being regarded as a reserve section, must specialize in nursing and blood transfusion. This means more attachments to hospitals and also blood transfusion courses, but it is the only way.

(25) On the administrative side it is imperative to train at least three times the number of clerks shown on the War Establishment and to get every likely pay clerk off on a course. After the surgical teams the QM. should have first

choice in personnel. Improvised cooking in the field must become second nature to all ranks.

(26) The R.A.S.C. section, although seldom more than a dozen of it go on the parachute phase of an operation, are every bit as important as the R.A.M.C. element. Due to the lack of transport after landing it is essential to have fitters to mobilize captured enemy vehicles, and the electrician is invaluable in ensuring adequate lighting arrangements for the M.D.S. The R.A.S.C. are also combatant personnel and are infantry trained. It is therefore important that their weapon training is of a high order and that drivers are not merely regarded as such.

Movement by road, including night convoys, camouflage of vehicles and positioning of air sentries must become automatic with them and be a hundred per cent efficient.

(27) The necessity for digging slit trenches is very real when surrounded by the enemy and the only way of ensuring efficiency in this line is to make the unit repeatedly dig slit trenches during exercises.

(28) It is considered worth copying the German parachutists and encouraging all ranks to learn at least one foreign language—but this must be done during parade hours.

(29) The officers, first, last, and all the time must look after their men. They should be ready at all times to listen to their complaints and quick to dismiss frivolous ones. They must always maintain their positions as *leaders*. As much time as possible in the training programme should be given to "Section Commander's Disposal" in order to foster responsibility in the officer and to enable him to get to know his men as individuals. The good officer will recognize potential refusals early and much future trouble in the section will be saved since refusals to jump are very "infectious."

(30) Lastly, outside the training programme, there is still the importance of organizing all ranks in games, debates, discussions, concerts, all ranks dances, etc. The ideal is to throw officers and other ranks together "off the record" resulting in the officer gaining more knowledge and admiration of his men and the other rank deriving more confidence in, and more respect for, his officer.

(31) Success in all these points will produce a real team which is what a parachute field ambulance must be if it is to do its battle job efficiently.

ADMINISTRATION AT THE BASE.

(32) All parachute units have a base from which they launch operations and to which they return for refitting after the battle is over. Administration at the base is therefore divided into two distinct phases: (a) when the complete unit is there, and (b) when home details only are there.

(33) It is a platitude to say that a unit badly administered at the base will do badly in action. In a parachute battalion there is a special administrative officer and approximately forty other ranks who are not parachutists in the operational sense. In a parachute field ambulance, however, there are no special administrative personnel and the whole problem is very difficult.

(34) Most officers, including the C.O.s, are extremely young and want to be

regimental, rather than administrative officers. There are always officer casualties on operations and they have almost invariably got to be replaced from within Airborne Forces. In a parachute brigade group it is a sound plan to regard the brigade HQ. M.O., the officer i/c Section 4 and the first line reinforcement officer as potential 2 i/c and therefore as potential C.O.s. Their training for their future duties must be the personal responsibility of the C.O. It is considered that this low age factor in C.O.s and 2 i/cs must be accepted and, if anything, encouraged.

(35) The two officers primarily concerned with administration when the unit is at the base are the C.O. and 2 i/c. It is a pity that the latter is not known as the "Deputy C.O." because that is what he is and he must not be regarded as the administrative expert as is so often the case. There must be absolute co-operation between him and the C.O. on all matters affecting the policy and training of the unit.

(36) The division of administrative duties in the unit may be summarized as follows:—

(a) *Commanding Officer*

Training	}	with 2 i/c.
Policy		
Imprest account		
War diary		
All matters affecting officers		
All correspondence with higher authority		
Personnel (with 2 i/c and R.S.M.),		
Liaison with brigade commander and A.D.M.S.		

(b) *Second-in-Command*

PRI
 Serjeants' Mess account
 Other rank documentation
 Training programme
 Personnel (with C.O. and R.S.M.)
 Liaison with brigade D.A.A. & Q.M.G. and D.A.D.M.S.

(c) The other administrative duties undertaken by officers, such as P.M.C., Messing Officer, Sports Officer, Entertainments Officer, Welfare Officer, Education Officer, P.A.D. Officer, Fire Officer, etc., have to be considered very carefully. Selection for these appointments will naturally depend upon the talent available in the first instance, but versatility should always be aimed at and officers should be changed around at least every three months—an ideal only possible in peacetime.

Of all the jobs enumerated it is felt that that of Messing Officer is the best test of the administrative mind and a good Messing Officer is a potential 2 i/c.

The specialist officers are seldom administratively inclined but are usually a good choice for welfare and education duties. Attached officers, i.e. the Dental Officer and the Transport Officer should *never* be employed in an administrative capacity outside of their own spheres. The practice of using the Dental Officer as an "Adjutant" is a bad one since he cannot become 2 i/c.

and if a C.O. must have an "Adjutant" he should always choose an R.A.M.C. officer likely to become a 2 i/c.

(d) The Section Officer must be held responsible for his Section's clothing and equipment—the QM. will put him on the right lines—and he should be encouraged to produce S.C.D. Training Programmes and orders for Section exercises. He should be given the disciplinary powers of a Company Commander, but only after he has received a good grounding in Military Law.

(e) The R.A.S.C. Section must be treated as a whole and the Transport Officer made responsible for its administration. He is also the unit Weapon Training Officer.

(37) When the unit is away on operations the Home Details Officer has the following duties:—

(a) Administration of all personnel L.O.B. and of reinforcements joining at the base.

(b) Maintenance of barracks and equipment.

(c) Despatch of kits of casualties to Effects Branch.

(d) Visits to wounded in U.K. hospitals and to next of kin.

(e) Sending a weekly "Diary of Events" to the C.O. overseas.

OPERATIONAL PREPARATIONS.

(38) The C.O. of a parachute field ambulance must be more *security* minded than any other field medical unit C.O. for obvious reasons.

Very short notice is given of an Airborne Operation. Generally speaking, the C.O. will be given the outline plan, but not the date, anything from a few days to about three weeks prior to the operation. The 2 i/c and chief clerk will possibly be briefed about a week or ten days before, and the remainder of the unit not more than four days before D-Day.

(39) Elaborate briefing of all ranks is a feature of Airborne Forces and involves much time in the preparation of briefing material. There are maps to be got ready, air photographs to be pieced together and also mounted for stereoscopic use, and a sand or plasticine model of the area has to be made. It is felt that the field ambulance must have its own briefing room instead of sharing one with brigade HQ. From the above points it will be appreciated that the C.O. has a very tiring time, from the day he is briefed until the initial parachute landing is over, just attending to the "G" side alone.

(40) On the actual planning side there are two points the C.O. must consider right away with the A.D.M.S.: (a) Clearance of D.Z. (Dropping Zone) casualties—and this requires most active co-operation from the brigade commander. and (b) the question of re-supply.

Nothing is more disheartening to a C.O. than to have equipment for re-supply sent to him two days before his unit is due to move into the Transit Camp and to have to pack and paint containers, etc., at that late stage.

This question of re-supply packing could well be taken out of the hands of parachute field ambulance and done centrally, away from the unit in every sense, as in India.

(41) In the preparation stage it has to be carefully considered what personnel are to be left behind at the base. First-line reinforcements are obviously left there and in this respect the first-line reinforcement officer must not be the worst officer in the unit. The job at the base is an important one and a keen officer will get on with barrack improvements, etc., while the unit is overseas. But leaving first-line reinforcements is not enough. A senior N.C.O. from the QM. Stores and an N.C.O. clerk must also be left behind. It is common practice to leave the QM. himself behind but it is considered preferable to have him on the operation to marshal re-supplies on the D.Z. A cook, too, will be wanted, and a truck and driver.

(42) An important part of the preparatory stage is to think in advance of the welfare of the unit overseas. It is a good thing to keep "frozen" in U.K. a stock of library books, gramophones and records, wireless sets, sports kit, N.A.A.F.I. packs, etc. The books can be divided up among personnel before emplaning and will constitute an immediate library on landing. It is always appreciated if the Home Details Officer forwards to the unit overseas the daily papers they were accustomed to get at the base.

(43) The unit will usually move into a Transit Camp anything up to a week before the operation. Surplus kits are handed into the QM. Stores just prior to this and it is important that all articles are clearly labelled and that a receipt is obtained for them. Keys of safes, stores, etc., should be handed over to the first-line reinforcement officer not less than twenty-four hours before the move to the Transit Camp.

OPERATIONAL DEPLOYMENT.¹

(44) In order to avoid being seemingly theoretical in this section there are attached at Appendix "F" the operational load tables and at Appendix "G" a sketch map of the actual deployment of 224 Parachute Field Ambulance on operation OVERLORD. From these Appendices the following points emerge:—

(a) The necessity for wide distribution of all items of medical equipment to ensure the arrival of essentials at the other end. On operation OVERLORD only one-third of the personnel of the unit mentioned above materialized on D-Day and, of that number, approximately 50 per cent. had their medical packs, etc., destroyed in the swamps. Only one Jeep arrived by glider—and this had to be given to the R.E. in order to demolish some vital bridges—and not one single item of the re-supply programme ever reached the unit. The sea-tail fortunately came through the enemy lines intact on D plus 2 and the position was saved.

(b) Personnel must be evenly distributed throughout the aircraft, e.g. the C.O. and 2 i/c never travel together, nor do the surgeons and other rank key personnel. Seven aircraft (Dakota) type and three gliders (Horsa) is the normal allotment to a parachute field ambulance for operational purposes.

(c) Essentially forward surgery is done. 224 Parachute Field Ambulance were in the position shown in the sketch-map at Appendix "G" for fourteen days.

¹We regret that space did not permit our publishing the rather comprehensive appendices to Colonel Young's paper. The equipment for a P.F.A. is now being revised.—Ed.

For the first four the enemy was all round the position and throughout the entire period he was seldom more than five hundred yards from the M.D.S. During this period 822 casualties were admitted to the M.D.S., 112 major operations were performed, and there were only 17 deaths. There can be little doubt that such a position is too far forward for ideal surgery to be done—heads and bellies do badly under mortar fire—but it is the only solution until a successful link up with the ground forces is made. From the patient's point of view, however, surgery at this level is more hopeful as a life-saving measure than the "forward" surgery of the C.C.S.

(45) To recapitulate just a little, a parachute field ambulance is deployed as follows: (a) Base details, which have already been considered; (b) parachute element; (c) glider element, usually three gliders with four jeeps and two trailers; (d) sea tail, remainder of the transport.

(46) On the air side of the operation the following factors must be realized: (a) There is no preliminary reconnaissance of the area; (b) initially there is no divisional control by the A.D.M.S. and the field ambulance C.O. is S.M.O. to the brigade commander; (c) there are usually immediately casualties on the D.Z.; (d) there is no L. of C.; (e) it may be necessary to defend the M.D.S.; (f) seldom, if ever, do all the personnel and equipment arrive anything like intact in the battle area.

(47a) A parachute field ambulance C.O. should always plan on general principles and always consider alternatives to each phase of his plan as operations have a habit of not going according to plan. Appreciation of the situation must be constantly uppermost in his mind.

(b) Prior to the operation it is usual to detach the whole, or parts of Sections 1, 2 and 3 to the three battalions in the brigade. This gives a maximum total of 2 officers and 37 other ranks R.A.M.C. with each battalion and allows the battalion to be medically self-contained for twenty-four hours if necessary—communications between the battalions and the M.D.S. take time to develop. Under such circumstances the Section combines with the R.A.P. to form an A.D.S. Casualties to battalion R.A.M.C. must be replaced from the Section and the Section Officer is always the potential R.M.O.

The field ambulance H.Q. party may travel with brigade H.Q. or be split up within the brigade group. It invariably joins brigade H.Q. at the rendezvous on the ground.

(c) When the brigade group drops the scene on the ground is chaotic to say the least of it and this is the time when the *Officers' leadership* is so essential. The problem of D.Z. casualties is an extremely difficult one, especially on night operations. It is regarded as a field ambulance responsibility entirely and the battalion R.A.M.C. personnel should not be involved in it—it is more important for them to get off with their battalions. One section may be given this task of D.Z. clearance, or perhaps all four sections will be used. To quote 224 Parachute Field Ambulance once again—on OVERLORD one section was given the task and most of it was taken prisoner; on VARSITY/PLUNDER all four sections were employed but even with the help of some eighty prisoners the D.Z. was

not cleared of casualties until nearly twelve hours after the drop. It must be admitted that there is as yet no satisfactory solution to this problem.

(d) No attempts should be made to leave the rendezvous, which is usually a short distance from the D.Z., until orders are received from brigade H.Q.

(e) Where possible the M.D.S. should be sited within a battalion perimeter as that considerably reduces defence responsibilities.

(f) A surgical team should not be opened until it is quite certain that the brigade commander intends to hold the area until link-up with the ground forces takes place.

(g) As soon as possible a reconnaissance of all local food, water and vehicle resources must be made and all vehicles, including the useful horse and cart, capable of carrying casualties seized.

(h) The field ambulance C.O. should attend personally to the opening of his M.D.S. This should be a simple organization initially of *reception, treatment and wards* and elaborate details can be added later.

Once the position on the ground is reasonably stable and communications with the R.A.P.s are open Section personnel are recalled as necessary. The officers are the key personnel and are all required for medical work—triage, resuscitation, blood transfusion, anaesthetics. It is sometimes necessary to bring in the M.O. from brigade H.Q. Professional versatility on the part of all officers is absolutely essential.

(i) The excitement of a parachute operation gives way to fatigue—as does carrying stretchers. More men than are necessary to do a job should never be employed and forced rest in slit trenches for those not working must be organized as soon as possible.

(48a) When a parachute field ambulance is employed in a ground role there are two main problems: (i) There is not sufficient transport to move the unit complete, and (ii) being on the L. of C. it is doubtful, at least in static warfare, if the surgical teams should remain with the unit. If they are detached to a C.C.S. or hospital the field ambulance is left with a total of 97 other ranks R.A.M.C. only.

(b) In an airborne role, as has been shown, the unit finishes up with a central M.D.S.; in a ground role this is the start line. The M.D.S. is best sited not more than one hour's ambulance car journey from any of the battalions (time and not distance is the important factor).

(c) An ambulance car or stretcher jeep, or both, with a junior N.C.O. and three men should be attached to each battalion R.A.P. and be changed over every week or fourteen days, depending upon the operational strain of the position.

(d) In a rapid advance it is almost certain that the C.C.S. will lag behind—in Germany it was not uncommon for it to be more than sixty miles behind the M.D.S. on a virtually unprotected L. of C. It is considered that, under such circumstances, the surgical teams should be with the unit, even if it does mean leaving nursing orderlies looking after small nests of post-operative cases all along the axis of advance.

It is more essential than ever to keep an ambulance car with each battalion and, in addition, a half-Section should be attached to brigade H.Q. with two ambulance cars and a jeep. This is especially important if the A.D.M.S. is only opening one field ambulance at a time and the "Leap Frog" system is in operation. On such occasions the field ambulance C.O. gets hopelessly out of touch with his brigade and the officer i/c the half-Section at brigade H.Q. becomes responsible for clearing casualties from the battalions to whichever field ambulance in the division is open at the time. Provision of wireless for the field ambulance would overcome this problem.

CONSIDERATIONS OF A.F. I 1248 AND A.F. G. 1098 EQUIPMENT.

(49) It must be realized from the outset that there is nothing in the A.F. I 1248 special to Airborne and only a few items in the A.F. G 1098 such as stretchers, folding, Airborne, trestles, Airborne, trolleys, folding, bicycles, folding, carriages, stretcher, folding, Airborne, crosses, distinguishing, Airborne, packs, medical types "D" and "S," etc., and the special individual clothing and equipment peculiar to all parachutists.

(50) The A.F. I 1248 is lavish and includes sufficient items for five days re-supply. It is packed by the field ambulance into special "D" and "S" packs, but it would be much simpler and save wastage if these packs were issued complete by medical stores. The "D" and "S" packs have proved their worth over and over again and have definitely come to stay.

(51) The A.F. G 1098 could easily stand considerable reduction as quite a proportion of the equipment has never been required for use. Certain items are of little use at all, e.g. the carriage, stretcher, folding, Airborne, and other items are on too excessive a scale, e.g. these are 46 harnesses, manifold.

(52) Certain equipment should, however, be added to the present scale and the main items of this are as follows:—

(a) a 1 kW. or 2½ kW. lighting set should be provided as in other field ambulances. The parachute field ambulance is only provided with three Tiny Tim portable charging sets and thirty 12 v. batteries. Such an arrangement is only makeshift at the best of times and is not consistent with the best possible surgical treatment in a M.D.S. A lighting set proper can easily be placed in a jeep trailer in a glider on operations and a second set could follow up with the sea-tail.

(b) Post-operative nursing on Airborne stretchers is far from desirable and it is submitted that safari beds of the Hounslow type could be jettisoned on the D.Z. and not only solve this problem but also release stretchers for the purpose for which they were designed.

(c) Another useful addition to the A.F. G 1098 would be the provision of a stencil set for producing directional signs in a hurry.

(d) Wireless has already been mentioned and it is considered that the solution to this problem is a 22 set in a jeep detached from "J," etc., Section of divisional signals, complete with driver and operator.

CONCLUSIONS.

(53) Since the formation of 16 Parachute Field Ambulance in 1942 a comprehensive field medical service has been built up within Airborne Forces which has outstripped all previous ideas of forward surgical treatment. Results, in terms of saving of life, have been better than those obtained by normal ground field medical units.

(54) These results must be mainly due to the special allotment of R.A.M.C. personnel in a parachute brigade: (a) Two surgical teams within the War Establishment of the parachute field ambulance; (b) a medical officer at brigade H.Q.; and (c) eighteen other ranks R.A.M.C. on the War Establishment of each parachute battalion.

(55) Few R.A.M.C. personnel, especially other ranks, have been volunteering for parachute duties and therefore, if parachute field ambulances are to be maintained and developed, special attention will require to be paid to this branch of the R.A.M.C.

(56) It is submitted that the Airborne arm of the Service is only in its infancy and that Airborne medical services will have to be constantly reviewed in the light of future developments.

The following points are considered to be worthy of immediate attention: (a) The correlation of all parachute field ambulances' operational reports, etc., with a view to deducing agreement on the War Establishment and deployment of the unit; (b) examination of Airborne medical services in the United States Army. Considerable liaison existed with the Americans during the war and, of course, the commander of First Allied Airborne Army was an American. It is felt that much can be learned from the Americans and vice versa; (c) the formation of a R.A.M.C. Parachute Company at the R.A.M.C. Depot. This could be run along the lines of a cadre parachute field ambulance.

ACKNOWLEDGMENTS.

I wish to thank Major-General E. L. Bols, *C.B., D.S.O.*, for permission to use the quotation at the head of this paper, Major-General J. C. A. Dowse, *C.B., C.B.E., M.C.*, for his constructive criticism of the original draft, and Colonel D. S. Skelton, *C.B., D.S.O.*, for his advice on the final paper.

I would also like to acknowledge the encouragement given me at all times by my teachers and pioneers in the Medical Services in Airborne Forces—Brigadier A. Austin Eagger, *C.B.E.*, Colonel M. MacEwan, *D.S.O., O.B.E., D.F.C., T.D.*, and Colonel P. R. Wheatley, *D.S.O.*

Finally my thanks are due to Brigadier G. S. McConkey, *O.B.E.*, for permission to submit this paper for publication.

Review.

THE CASE OF RUDOLPH HESS. Heinemann. Price 12s. 6d.

This is an eminently readable book and is in the nature of a real life thriller. It is edited by J. R. Rees, *C.B.E.*, M.D., F.R.C.P., formerly Consulting Psychiatrist to the Army. The team of contributors has done its work well and the narrative flows smoothly from first to last.

The sanity of Rudolf Hess was an international problem. Here the fluctuating nature of his mental illness is described in detail with the minimum of technical jargon. His solo flight to Scotland, his eventual surveillance by officers of the R.A.M.C., the attempts at suicide and his trial at Nuremberg are stages in this extraordinary story. Great credit is due to those officers and men of the Corps who had this difficult patient to care for.

The main interest in the book from the technical point of view was the question of the diagnosis. Was he sane? If so how sane was he? The legal angle is given in detail in verbatim excerpts from the proceedings of the trial. The dramatic announcement by Hess that he had been pretending loss of memory, of course, made all the world think he had fooled the experts. It is made clear in this book that the mental state of Hitler's Deputy varied from cunning normality through neurotic instability to undoubted insanity. The complete nature of the psychiatric picture made it necessary for serial observations to be available to establish an accurate diagnosis.

Perhaps the main value of this work will be to make it more clear to the layman that emotional illness is never wholly definite like a fractured bone and that the "either-or" attitude cannot be applied rigidly where things are not either black or white but are mostly different shades of grey.

Lastly the case of Rudolf Hess is a warning that the recent vociferous demands for a leader when our nation is in difficulty might evoke a response from a grandiose mentally ill demagogue whose leadership will be fraught with disaster.

A. T.

Notices.

IN MEMORIAM.

Brigadier-General Elliott C. Cutler, M.D., F.A.C.S., F.R.C.S., died August. 1947.

Large numbers of officers of the medical service who were in the European area during the recent war will remember the commanding figure of Elliott

Cutler. Indeed there were some who had known him in the 1914-18 war.

An outstanding surgeon, he was internationally famous for many years. No choice as consulting surgeon to the American Forces in Europe could have been more welcomed by his British colleagues, for here was a man at the height of his professional career, energetic, wise, helpful, and withal a charming and delightful personality, and a good companion.

His strong, lean physique was livened by the twinkling eyes, the sparkling smile, and the ready flashes of humour, and to his distinguished appearance he added a quiet, confident, impressive address, which carried audiences, large or small, irresistibly with him. To meet him was an experience, to spend some time with him, whether on professional duty or pleasure, was an unforgettable delight, and to count oneself his friend was a privilege indeed. He took a great interest in the R.A.M.C., and only recently he wrote inquiring about an incident in the history of our Corps which had come to his notice and which intrigued his inquiring mind.

He was a frequent visitor to the College and Mess at Millbank, and one of his last official appearances in this country was as a guest at the Consultants' Dinner in June, 1945.

Elliott Cutler was a great surgeon, a wise and kindly counsellor, honoured in this country and his own, respected and loved by his friends. He has gone from among us and we are the poorer by his passing.

CHANGE OF NAME.

Burroughs Wellcome & Company are now issuing the new analgesic *dl*-2-Dimethylamino-4:4-diphenylheptane-5-one Hydrochloride under the trade name "Physeptone." (Note: The analgesic was originally announced as "Miadone.")

The change has been made to avoid confusion with other established names. Supplies of "Physeptone" are now available.

ROYAL SOCIETY OF MEDICINE.

THE *Royal Society of Medicine* have recently made a new Bye-Law, which is as follows:—

"If a Fellow be or may for the time being be engaged in the Medical, Dental or Veterinary branches of His Majesty's Forces and if he be or may for the time being be engaged in the Medical, Dental or Veterinary branches of the Forces of any other country who shall for the time being be resident or stationed in this country, he shall, subject to future Bye-Laws, pay annually to the Society a subscription rate of £3 3s. 0d. per annum."

This means that wherever a man is stationed, as long as he is in the Forces, or a regular on the retired list, he can enjoy full privileges at the overseas rate of subscription.

The privileges of the Society are well known, and include the receipt gratis of the Proceedings of the Society which includes all sections and the use of the Library which contains 150,000 volumes, and from which photostatic copies of articles may be obtained.

It is hoped in the future to install microfilm projectors in large military hospitals throughout the world, which would enable Fellows with microfilm information to read it on the spot.

In addition, it is hoped to revive in the near future the United Services Section. Forms of Application for election can be obtained from the Secretary, 1, Wimpole Street, London, W.1.

Please bring this to the notice of every medical and dental officer. I hope that many officers will take advantage of this generous arrangement.

ALEX HOOD,
*Lieutenant-General,
Director-General, Army Medical Services.*

Appreciation.

The sudden death of "George" Fulton was a great shock and sorrow to all of us who worked and lived with him here, and must indeed also have been so to all his very numerous friends throughout the Corps.

His death is a great loss to the Corps which he loved and in which he had done such great work, and had every prospect of completing a brilliant career.

As a man, beneath an apparently somewhat gruff façade, he had not only a strong and very determined character but also had that pleasant personality which endeared him to so many friends and which was the basis of his success in his work and official contacts.

With an outstanding moral sense of duty and the job to be done, he had a flair for picking the right men to do it and a happy knack of imparting his enthusiasm, or of successfully impressing his views of what should be done on those with whom he worked or came in contact. His strong sense of humour helped him and others over difficulties while his determination held him to the course mapped out.

His knowledge of his speciality, Hygiene, was profound and even brilliant; but he also had that great gift of common sense in the application which enabled him, in whatever sphere he worked, whether as D.A.D.H., Rawalpindi District, D.D.M.S., L. of C. 21 Army Group or D.D.H.&P. at General Headquarters, India, to raise the hygiene work of the forces to a level second to none.

Before he died he had the satisfaction of completing two works typical of his determined energy and enthusiasm: the co-ordination and simplification of the complicated documents which afflict the medical services of the three

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armed forces, and the 1946 Annual Hygiene Report, the last of the reports of the Army in India.

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He did a grand job and died peacefully in full harness.

TREFFRY O. THOMPSON,

Lieut.-General, Director of Medical Services.

No. 5070/D.M.S.I. (in P.R.S.O.).

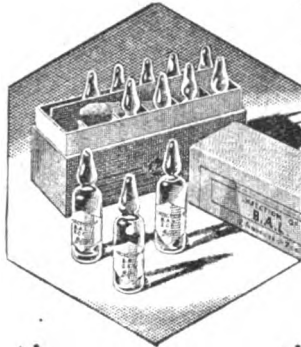
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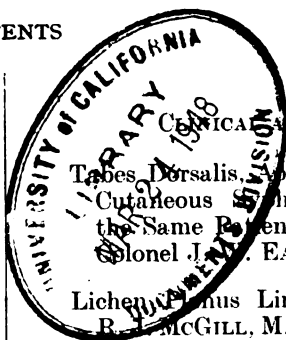
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UNUSUAL ASPECTS AND THERAPY IN AMŒBIC DYSENTERY.

BY

Lieutenant-Colonel L. R. S. MACFARLANE, *O.B.E.*, M.B., B.Ch., D.P.H.
Royal Army Medical Corps.

(Continued from page 234)

PART II.

DIAGNOSIS.

GIVEN a microscope and a minimum of equipment as the writer was, diagnosis was fairly reliable. The trouble was that many patients arriving had already been missed through lack of diagnostic facilities or not seen at all by their own doctors. As emetine was as difficult to obtain up country as at the Base Hospital this was not, however, of very great import. Once they had arrived it was, however, important to sort them out so that such treatment and precautions that we had at our command could be resorted to.

Nothing can be added to the already established facts on diagnosis except in the acute type of case. It was in the differentiation from the other tropical diseases and deficiency conditions that we found the most interest.

Diagnosis from clinical symptoms in the serious type of case was made from the typical stools, the intermittent nature of the onset, nausea, often slight fever and confirmed by microscopic findings. Except in acute cases stools rarely went above 15 a day. In the acute cases, however, and some of the severe type, stools went as high as 40 a day. (Castellani postulates that stools never exceed 30 a day). Furthermore, the onset was frequently violent with no intermittence. The severity of the onset and course was typical of the worst cases and is not hinted at in most writings—even Stitt ("Tropical Diseases," 6th edition) who is one of the few writers who note that stools may go as high as 50 a day does not describe the violence of the acute cases as noted by the writer. The acidity, odour and appearance of the stools were characteristic. In complicated cases or mild cases diagnosis was only arrived at by microscopic examinations. So protean can be the manifestations of amœbic dysentery that many cases were only diagnosed in routine examinations or in examinations for other conditions.

Microscopic examinations were carried out in the simplest manner. The stools were obtained as soon as possible, but in a muggy climate like Siam this was not of extreme importance. We found that amœbæ remained active for 75 minutes. Fresh specimens in saline were examined for the vegetative forms and in Lugols iodine for cysts. When Lugols iodine was unobtainable reliance had to be placed on seeing the chromatoid bodies. Eosin was unobtainable. The chief points in the diagnosis of the vegetative *Entamœba histolytica* were the presence of red cells ingested, the clearer cytoplasm and absence of bacteria and food particles, the propulsile projection of the clear pseudopod—much clearer than the remaining body at first—the central nucleolus—and the size. Stitt refers to the effect of climatic conditions on amœbic outbreaks and cites outbreaks after rains. The writer invariably found that in hot steamy weather, the percentage of positive stools for vegetative forms also rose—even for known cases—in other words the weather seemed to stimulate the “shower of amœbæ” frequently referred to—it would seem highly possible then that more cases are *diagnosed* in steamy weather rather than occurring in such conditions. This fact was so noticeable that the writer’s chief assistant used to say on such days, “We’ll have a good bag to-day, Sir!” He was invariably right.

DIFFERENTIAL DIAGNOSIS.

The conditions to be differentiated were numerous—any condition in fact that could cause diarrhœa or gastric discomfort. The chief diseases and conditions met with which needed differential diagnosis were as follows:—

Bacillary dysentery.	Cholera.
Pellagra.	Duodenal or gastric ulcer.
Ankylostomiasis.	Hæmorrhoids.
Strongyloid infections.	Carcinoma of rectum.
Ascariasis.	Food poisoning.
Other worm infections.	Appendicitis.
Typhoid and paratyphoid.	Sprue.

BACILLARY DYSENTERY.

In most cases no difficulty was experienced. The course was definite without intermissions, the illness came on as a rule as a definite acute condition, as opposed to the often vague commencements of amœbic dysentery. The condition was fairly painless except for the inevitable discomfort of the frequent stools. The stools were more frequent as a rule, but it must not be forgotten that a really acute amœbic dysentery can produce as many stools as the worst bacillary type. The patient was generally febrile at the onset, but this too may be found in amœbic dysentery. The stools were not offensive, commencing with fæcal matter, interspersed but not intimately mixed with blobs of blood-stained clear mucus, passing on to stools composed entirely of blood and mucus, blood alone, or clear mucus alone—the latter often purulent and in long drawn out cases composing the entire composition of the stool. Stools

were invariably found to be alkaline. Nausea was common, whereas the amœbic cases showed no nausea except in the very acute or final stages, apart from that brought on by drugs.

Stool examination gave typical pictures—the fine spawn-like appearance of the fully developed bacillary exudate being unmistakable. Macrophages may be mistaken for amœbæ to the uninitiated eye, but the typical propulsile projections of the amœbic cytoplasm should never allow this mistake. Secondary organisms were absent in bacillary cases and so were Charcot Leyden crystals. Rouleaux formation of R.B.C. were more common in amœbic exudes. Culture was of course denied to us.

The mixed infections gave cause for thought; apart from genuine mixed infections it was often noted that attacks of bacillary dysentery brought hitherto hidden cases of amœbiasis to light, probably in many cases a Westphal phenomenon. If available, sulphaguanidine was a sound diagnostic drug for separating the subacute or chronic bacillaries from amœbic dysentery.

PELLAGRA.

The diagnosis from pellagra of amœbic dysentery, especially in the chronic stage, often presented considerable difficulty if amœbæ or cysts could not be demonstrated. In addition, pellagra was often present when the amœbiasis was contracted and conversely the dehydration and purgation of the dysentery frequently precipitated the onset of pellagra. In the continued absence of the specific signs of amœbiasis the typical skin rash, the grooved tongue, and the mental changes with increased knee-jerks reasonably pointed the diarrhœa as being due to pellagra. When it was available the response to nicotinic acid was in itself diagnostic.

Stool examinations failed to show blood or pus cells and of course no ulcers could be detected by proctoscopy.

One was frequently faced with a chronic diarrhœa with a history of amœbiasis, many attacks of bacillary dysentery and pellagra. The trouble was to assess the present condition and the routine adopted was roughly as follows:—

Stool examinations were made; amœbæ, cysts, R.B.C., or pus cells gave the clue to the decision—dysentery, whether amœbic or bacillary. If nothing could be gained of importance from stool examinations and when the drugs concerned were available trial dosages of sulphaguanidine and nicotinic acid in turn were given. If the response to either of these was suggestive, the appropriate treatment and diet such as it was, was instituted. In the earlier days one had to rely entirely on the stools and many cases were never solved until the post-mortem table where the appropriate ulcers, or the “tissue paper” intestine and minute spleen, with increased fluid under the dura, characteristic of pellagra gave the diagnosis. Often all three conditions were present.

ANKYLOSTOMIASIS AND STRONGYLOID INFESTATIONS.

Both the above can give rise to a chronic diarrhœa. The chief points of differentiation are as follows:—

Ankylostomiasis.—Vomiting may accompany the diarrhœa and anæmia is constant. Most of our patients were anæmic anyway but the ankylostomiasis cases were of a severer nature. Stools showed the characteristic ova, but of course not the larvæ. This might have occurred in a warm climate if the stools had been left long enough but for hygienic purposes this was always avoided. Pus and blood cells were not seen. Charcot Leyden crystals were occasionally seen. The ova showed clearly segmented morular masses—eight segments in each.

In patients infested by Strongyloides stercoralis.—The clinical picture was a chronic diarrhœa. R.B.C. and pus cells were common, the infection being often in the large bowel as well as the small and frank blood and pus were often demonstrated in the stool. The writer found Charcot Leyden crystals in 60-80 per cent of all cases. They were more diagnostic than even for amœbic dysentery.

The ova were seldom clearly segmented; contrary to many writers they were often seen in the stool in all stages from the morular mass to ova containing the fully formed coiled embryo. It was, however, rare to find the ova in the stool without the rhabdiform larvæ being seen in the same preparation. With practice the Strongyloid egg can be easily spotted from the Ankylostome egg and the former is more easily confirmed by the usual presence of the larvæ also.

It has been stated that if ova and larvæ are found in the stools the ova will be ankylostoma and the larvæ strongyloides. The writer disagrees with this. The clinical symptoms in many of these cases were not suggestive of mixed infections and the presence of ova with coiled embryos inside clinched the fact that Strongyloid ova do appear in the stool even if at a late stage. Such observations it should be noted were made invariably on fresh stools, in which time for development had not taken place. It is also of interest to note that Strongyloides gain entry in the same manner as Ankylostoma, via the skin of the feet, the lymphatics, lungs and gastro-intestinal tract and can cause the same symptoms of invasion. A party of prisoners-of-war working by order of the Japanese in bare feet, spreading human fæces as manure in one of the writer's camps produced 25 cases of typical ground itch and all produced ova and rhabdiform larvæ of *Strongyloides stercoralis*—8 developed bronchitic symptoms about ten to fourteen days after the ground itch. Anæmia and vomiting were not seen but diarrhœa was present.

The stool differentiation would appear to be as follows:—

ANKYLOSTOMIASIS	STRONGYLOID INFESTATION	AMCÆBIASIS
R.B.C. & P.C. absent.	R.B.C. & P.C. present.	R.B.C. & P.C. present.
Ova seen.	Ova seen.	No ova.
Larvæ absent.	Larvæ present.	Larvæ absent.
Charcot Leyden Crystals		
—perhaps.	C.L.C. 60-80%.	Frequently—C.L.C.
No cysts or amœbæ.	No cysts or amœbæ.	Cysts or amœbæ.

Clinical Differentiation:—**ANKYLOSTOMIASIS**

Vomiting
Anæmia

History of ground itch
and pulmonary signs.

STRONGYLOIDES

No vomiting
No marked anæmia.

Similar history.

AMŒBÆ

Sometimes vomiting
Anæmia not as marked
as in ankylostomiasis.
No such history.

Ascariasis.—Ascariasis presented no difficulties once stool examinations had been performed. *Ascaris lumbricoides* can cause dyspepsia and diarrhœa, with a burning sensation under the sternum and a sense of fullness. Unfortunately many mild and chronic cases of amœbic dysentery also gave these symptoms. Diagnosis was of course by microscope or by actually seeing the worm. This did not, however, disprove amœbic infection as well.

Other worms and parasites.—Chronic diarrhœa and digestive disturbances were sometimes caused by the *Trichuris trichiura*. *Lambliia intestinalis* also gave a sharp diarrhœa and was particularly apt to cause severe nausea. Stool examinations clarified the diagnosis.

Cholera.—Cholera may be confused with a severe attack of bacillary dysentery, especially Shiga but rarely with amœbic dysentery, except in the fulminating type of the latter. Hanging drop preparations of stools and the cytology usually settled the differential diagnosis. Without culture, however, there was always the liability of confusing acute choleric bacillary dysentery with cholera, but the extreme motility of the vibrio was generally easily demonstrated.

Duodenal or gastric ulcer.—We noted a considerable number of cases classed as above which eventually turned out to be amœbic cases.

This was more noticeable in cases from camps where facilities for doing makeshift gastric analysis were not available.

The diagnosis was always eventually settled by stool examination but clinically this resemblance should be noted and always borne in mind. For reasons at present obscure it was found that persons suffering from proven gastric or duodenal ulcer seemed to be more subject to amœbiasis and where cases arose from those already in hospital for other complaints the "ulcer cases" were always amongst the highest incidences.

Hæmorrhoids.—Patients reporting bleeding from the anus even when piles were present were always given stool examinations. It was quite common in the "quiet" amœbics to have intermittent hæmorrhages quite in keeping with an attack of bleeding piles—and it was only when the stools were examined that the true nature of the condition emerged.

Carcinoma of the rectum.—This was quite often confused with amœbic involvement of the rectum. Amœbic ulceration and stricture can give an almost identical picture with carcinoma of the rectum. In Thailand when there was any doubt it invariably proved to be amœbiasis and only twice has the writer seen the condition really to have turned out to be carcinoma of the rectum. Proctoscopy did not always help; where no positive stool results could be obtained and emetine and its derivatives were available the response

to the drug was diagnostic. Manson-Bahr in "Tropical Diseases" also makes this point, with which the writer is in agreement.

Food poisoning.—Periodic outbreaks of food poisoning were frequent, but became less as the prisoners got more and more acclimatized to the poor and dirty food provided and the inevitable contamination. Such outbreaks were obvious as they affected batches of men at a time and could generally be attributed to certain articles of food.

However, in certain cases the first intimation of an attack of either bacillary or amoebic dysentery was a bout of diarrhoea and vomiting thought to be food poisoning until examination of the stools revealed the cause. This was more common in bacillary dysentery but in quite a considerable number of amoebic cases this was the first sign.

It must also be noted that an attack of food poisoning was often the means whereby a latent infection by *Entamoeba histolytica* was brought to notice, either by simulating the disease or by the accidental finding of *Entamoebæ* in the stools examined as a routine in these food poisoning cases.

Acute and chronic appendicitis.—A tender palpable swelling over the appendix was common in heavy infections of the cæcum in amoebic dysentery. This sometimes arose gradually, sometimes acutely. It could easily be mistaken for an appendix abscess. In a patient with established amoebic dysentery this was often a great problem, as it was not unknown for genuine appendicitis to develop on top of amoebiasis. If emetine could be exhibited the chances of the condition being appendix abscess were large if it persisted or if it developed in spite of emetine treatment. If emetine was unavailable the diagnosis was extremely difficult but the chances were also in favour of amoebiasis. If emetine could be obtained and the lump immediately began to subside, the diagnosis was clinched. Where possible a few grains of emetine were given when we had any as a diagnostic. Otherwise we had to go entirely by clinical symptoms and the blood picture should show a higher leucocytosis than for amoebiasis alone. In these cases opened in error and proving to be amoebiasis, all that could be done was a cæcostomy and closure of the wound, also assuming the condition of the bowel wall made it possible. Medication as mentioned later in surgery in amoebic dysentery could then be resorted to.

Typhoid and paratyphoid.—These diseases were undoubtedly present as a cause for diarrhoea. They could only be diagnosed on clinical grounds in the absence of cultural facilities. Stool examinations were always performed first to exclude obvious causes. Many typhoids and paratyphoids were undoubtedly missed, but it is certain they were seldom confused with amoebic dysentery. A few paratyphoids were actually isolated by the Japanese when they carried out routine stool cultural examinations for cholera—but these were not found in the dysentery wards.

Sprue.—Sprue was expected but never actually seen in Thailand. As a differential diagnosis from amoebic dysentery it is scarcely worth mentioning. It, however, may and does supersede amoebic dysentery of long standing. All the cases observed which gave a sprue-like syndrome were ultimately labelled pellagra either on clinical, therapeutic or autopsy findings.

Extremely sore tongues were noted—they, however, invariably responded to nicotinic acid or multi-vit tablets when these were obtainable. Sprue-like symptoms were always accompanied by other symptoms of pellagra—viz. rash or increased knee-jerks. The diarrhoea in these cases was extremely like that in sprue, pale, frothy and projectile—but invariably accompanied by other pellagrous signs. At autopsy the “tissue-paper” gut, tiny spleen, and flattened brain convolutions from increased fluid were considered pathognomonic of pellagra but it is as well to remember that the first two post-mortem signs mentioned could also apply to sprue.

It must also be remembered that the prisoners’ chief food shortage was of fats, and on the whole pellagra was more to be expected than interference with fat metabolism. It is noted, however, that many chronic amœbics evacuated after V.J. Day have been labelled “sprue.” It must also be appreciated that these cases had many days before evacuation on generous Red Cross supplies—often very unwisely—it would appear to the writer that the sprue developed after the richer diet, or was at any rate aggravated, having coexisted with the pellagrous condition. The writer has recently met one of his own patients who developed definite sprue three months after returning to U.K.

Furthermore, these sprue-like cases before release did not show any severe degree of anæmia, unless complicated by malaria, and in the latter case quinine and blood transfusions soon repaired the damage—macrocytic anæmia was not noticed in these cases.

Sprue is a disease of Europeans in the tropics, but in our case as regards diet we were living as Asiatics—failure of phosphorylation of fatty acids, glycerol and glucose by an enzyme of the vitamin B₂ complex (Whitby and Britton, “Disorders of the Blood,” 5th edition) is said to be the original cause of sprue. On the diet given P.O.W.s pellagra is a much more likely answer. Lastly no marked achlorhydria or hypochlorhydria was noted in these cases as a group, as would be expected in sprue (Whitby and Britton, “Disorders of the Blood,” 5th edition).

In short, whilst amœbic dysentery may leave the stigmata of sprue it should not be confused with it. In Thailand the differential diagnosis would have appeared to be rather between sprue and pellagra than amœbic dysentery and sprue.

Malaria.—Malarial dysentery is well known. It often occurred in Thailand but the diagnosis needs no elaboration.

TREATMENT.

This falls into three headings:—

- (1) That given when we had emetine, E.B.I. and yatren.
- (2) That when we had none of the regular amœbicides.
- (3) That when we had in the later stages very limited Red Cross supplies and Japanese issue of emetine, E.B.I., yatren and a few other drugs of this nature.

(1) In Changi and in the first three months of the Base Hospital, Kanchanburi, treatment of amœbic dysentery was of the standard Army practice at

the time of capitulation. Emetine gr. 1—12 doses with an intervening rest of three days—with follow-ups of yatren or E.B.I. It is not proposed to elaborate this further. Suffice to say it was not easy to follow up the cyst examinations after discharge from hospital owing to the demands of the Japanese. Cyst carriers were undoubtedly let loose and sent up country. This must have had a considerable effect on the ultimate spread of the disease.

(2) When in April 1943 we had exhausted our stocks of emetine—the amœbic dysentery outbreak was well on its way. The only thing to do was to take stock of all our available meagre drugs and try any that might alleviate symptoms and keep the patients alive. At this stage this was all that was thought of. After a final check up it was decided to try out various drugs on patients and to decide which gave the most satisfactory results.

The following were tried out:—

- A. Quinine gr. 10 in $\frac{1}{2}$ pint water as enemata.

Thirteen cases were tried out. Only two showed definite improvement, one showed slight improvement, five transitory symptomatic improvement, five no response at all. It was decided *not* to continue this treatment except in conjunction with others as a follow up to eliminate cysts.

- B. Treatment as laid down by Beijner in the *Journal of Tropical Medicine and Hygiene*, 1923—256, viz. calomel gr. $\frac{1}{2}$ two-hourly for the daylight hours of three days followed by bismuth subnitrate gr. $7\frac{1}{2}$ two-hourly as above for another three days.

Price quotes Deaks and James in his "Medicine" (4th edition) as recommending bismuth subnitrate in amœbic dysentery.

Eighteen cases were tried on this and eleven showed definite improvement, four showed transitory improvement and three no improvement. It was definitely decided to continue this treatment on cases responding.

- C. A local remedy consisting of an astringent draught of caraway seed solution, about $\frac{1}{4}$ pint, three doses being given—one a day for three days.

This was followed by an infusion of paprika roots of $\frac{1}{4}$ pint on the fourth day. The cycle then to be repeated and the treatment to last altogether for three weeks. The materials had to be smuggled in.

Eight cases were tried out and the drugs did not justify the claims of the local inhabitants. Five had no improvement and the other three experienced some relief from the astringent draught only.

- D. We had by chance more santonin than we needed for *Ascaris* cases and it was decided to try its effect.

Dosage—a maximum one—of gr. 2 t.i.d. for five days.

Eleven cases were tried out. All experienced transitory relief, immediately after the drug; this soon wore off and in most cases they relapsed with severer symptoms than before. The treatment was dropped.

- E. Copper sulphate enemata. 1/5,000 enemata at 50°-55° C. of 2½ litres daily or on alternate days for 5-10 days. This is recommended by Beregoff, *Canadian Medical Association Journal* 1/1935. —641.

Nine cases tried out: Three had definite and remarkable improvement. Two others improved. One had no improvement and three were definitely worse after treatment. It was decided that the improved cases were those with disease in the lower part of the large bowel and the others with disease that could not be reached. It was considered a useful treatment for early cases and those which appeared by examination and symptoms to be confined to the lower part of the large bowel.

- F. Kurchi Bark. 1-3 5 gr. tablets of Kurchi compositus daily—this was obtained locally, *sub rosa*. Has been mentioned by Manson-Bahr.

Eleven cases. Three definitely improved, three no improvement, five made definitely worse. No uniformity of action could be seen in this drug and it was decided only to proceed with the three cases mentioned. Incidentally these cases were finally apparently cured by this treatment.

- G. M & B 693. 0.5 gramme four times a day for ten days or longer if satisfactory results obtained. It was thought better to give these small dosages and prolong them if satisfactory rather than give massive doses and waste the drug. Since we had no vehicle to convey the M & B 693 to the large bowel the effect would have to be systemic.

Nineteen cases. Seven showed definite improvement, three showed slight improvement and three transitory improvement. Five showed no improvement and one worsened. It was decided to continue this treatment.

- H. Santulin Tablets. Locally obtained by subterfuge again. These were a Far Eastern production of Welling Laboratories, Hong Kong, Shanghai, Siam and F.M.S. Each tablet was alleged to contain:—

“0.028 gramme (½ gr.) trioxymidoglucarseno, 0.122 gramme (2 gr.) Chinese medicinal root and ipecacuanha.” This was the actual label quotation. One tablet to be given three times a day.

Twenty-two cases were tried out. Ten showed definite improvement, six showed slight improvement and six no improvement. This proved to be the most satisfactory line of treatment attempted so far and it was decided to continue it.

We were then in a position to have several lines of treatment open; each case would be put on one or the other on its merits. If the patient did not improve on one, he would be switched to another until the one which suited him was found.

The various treatments were then: (1) Copper sulphate enemata for early and mild low cases. (2) Santulin. (3) M & B 693. (4) Bismuth subnitrate and calomel. (5) Quinine enemata as follow ups only.

The general treatment of all cases was as follows:—

For relief of purgation and sleeplessness we had luckily reasonable stocks

of camphorydine—minims xx or xxx were given as desired. Where this failed to control excessive purgation, relief was frequently obtained by giving enemata composed of $\frac{1}{2}$ pint of starch containing $\frac{1}{4}$ gr. of morphia. In very bad cases morphia injections had to be resorted to. Morphia was, however, very precious and had to be conserved.

Diet was the great bugbear. Rice and watery stew was the routine Camp diet—with occasional fish, beans, etc., as tit-bits. An impossible position for amœbics. The best we could do was to deny them absolutely beans and excess of green vegetables which proved too irritating and in the really bad cases give diets of papped rice or tapioca with the fluid portion of the stew, incorporating as much meat extract in this as was possible. A word about magnesium sulphate should be inserted here. The writer found that this drug was irritating in the extreme in amœbic cases. The practice of using large doses to quell diarrhœa up country had disastrous results if the case was amœbic. The excessive purgation and no doubt stretching and spreading of the submucous ulcers did the patient more harm than any beneficial effects warranted. Small doses of a drachm or half a drachm were useful in producing the parasite for diagnosis or in the relief of meteorism and distension, but beyond this the drug is in the writer's opinion absolutely contra-indicated in amœbic cases. Of sodii sulphate we had little or none and it was reserved when obtainable for bacillary cases.

Blood transfusions could only be carried out in a few cases owing to lack of donors, the camp being practically entirely a hospital one and the donors taken from R.A.M.C. personnel or convalescents, neither of which could maintain a steady supply.

As a result of this improvised system of treatment we found four categories of results: (1) The patient died. (2) The patient improved and in some cases to be referred to later was apparently cured. (3) The patient improved sufficiently to become a fairly quiet "chronic." (4) The patient after a period of chronicity tended to slip back into a dangerous condition.

In this latter category the writer and Major R. de Soldenhoff, I.M.S., decided to try surgery. This has already been referred to by Dunlop, E. E., in the *British Medical Journal* dated January 26, 1946. The particulars are as follows:—

SURGERY IN AMŒBIC DYSENTERY.

Out of the series of 140 cases reviewed at Kanchanburi, eleven were treated by surgery—there were two fatal cases, one, the initial, and one who had been left too late. The results were dramatic—the patients cleared up at once and became fairly mild chronics—a few had later temporary set-backs. Their outlook after months of misery was completely changed. The writer has no hesitation in saying that if facilities and staff had been available, all cases, the least bit distressed who could not get emetine or relief from other drugs would have been treated this way. Other cases are reported in the section referring to Nakom-Patom. The results were sensational enough to cause South-East Asia Command to call for a report on surgery in amœbic dysentery after V.J. Day, which was duly done.

Patients of the category mentioned were selected and if their cæcum appeared in satisfactory condition by manual palpation, the operation was proceeded with. Actually in all cases performed at Kanchanburi, the cæcum was found at operation to be suitable.

The abdomen was opened up by a gridiron incision and the appendix brought out through a separate incision and a tube placed in the appendix through a stoma. Both wounds were then closed except for the protruding tube and stoma. Where the appendix was non-existent a straight cæcostomy was performed.

The principle involved was to get at the affected areas of the colon by soothing and curative lavage, a procedure which could not otherwise have been attempted except by high postural enemata. Conditions prevailing and lack of skilled staff made this latter quite impossible.

After a few days washouts with saline, the patients were irrigated with one of the following—depending on which appeared to suit them best: AgNO₃, 1/10,000; Tannic Acid 1/5,000; CuSO₄, 1/5,000.

Potassium permanganate 1/10,000 was also tried, but proved too irritating and was abandoned.

The frequency of the washouts was gradually decreased and finally they were stopped altogether—by the end of the war as far as could be ascertained only one appendicostomy opening had failed to close in and heal.

With the exception of one case for which a little yatren and stovarsol was obtained, no other treatment was given.

In no case did cutaneous Amœbiasis develop.

Finally the results of the 140 cases under discussion at Kanchanburi were as follows: 54 deaths; 20 apparent cures; 66 still alive after one year and in nearly all cases checked as alive on V.J. Day.

Of the deaths, eight were not due to amœbic dysentery and four were moribund on admission. The death-rate was therefore 30 per cent as opposed to over 40 per cent in cases treated without emetine or not treated at all, in other camps up country.

As has been stated before, the primary intention of the treatment was to maintain life—cure was not hoped for. As time went on some of the cases appeared so well, and their stools remained negative so long, that it appeared that cure might have been effected. The following criteria of cure were therefore laid down. It is felt that the criteria of cure generally laid down for cases who have had emetine could scarcely be much more strict with reason in normal circumstances and that if these following criteria cannot be regarded as conclusive then the everyday criteria of cure of cases of normally treated amœbic dysentery are equally inconclusive. Furthermore, if it is agreed that amœbic dysentery eventually cures itself we are again faced with the problem: Does emetine really actually complete the cure? If we do consider that it does, then we must also consider the cases quoted in this paper as cures and they will be referred to as such for the purposes of this thesis. Later, discussion on self-limitation of the disease will have to be on these lines, and will be referred to near the end of this thesis.

CRITERIA OF CURE.

Many writers give different criteria. Some say six negative stools, some more, some less; Osler for example considered clearance tests should be done every three months for one year and then at six-monthly intervals for another year. Manson-Bahr in "Dysenteric Disorders" desires daily negatives for twenty-one days, or alternatively periodic sigmoidoscopy. The writer decided on the following: If the patient was free of all symptoms suggestive of amoebic dysentery over a period of three months, and only if this was so, and if during this period he had a minimum of *nine* negative stool results to *Entamoeba histolytica* vegetative or cysts or to amoebic exudate he was considered cured.

This was a strict test and exceeds that generally laid down by most. If possible the patient was followed up later.

In many controversial discussions with both the Japanese, Australians and later the Dutch, the writer stressed the importance of the clause "free of all symptoms suggestive of amoebic dysentery" during the probationary period. In many patients put through stool test courses by different doctors, varying from three in some cases to the nine required by the writer, the results were negative to *Entamoeba histolytica* vegetative and cyst forms but frequent stools, pain and diarrhoea, at intervals were occurring. Furthermore, many symptomless patients showed cysts.

It is probably far more likely that the so-called "self-limitation" of the disease is that the symptoms clear up and the patient lives in harmony with his parasites, only occasionally passing cysts. Furthermore, his lack of symptoms deludes him and his doctor into dispensing with further tests. The patient in these circumstances can hardly be classed as the harmless carrier *per se*, found according to Manson-Bahr up to 10 per cent in the United Kingdom. Cases are on record of amoebics flaring up after as long as twenty years after the original attack in conditions where they could not possibly have been reinfected, for example Australia, where the disease does not exist; it is therefore doubtful if the parasite is ever got rid of without some form of treatment. This discussion will again be referred to in the treatment section on Nakom-Paton.

It will be seen then that 66 patients were kept alive without recognized treatment over a long period until it could be obtained and that 20 were cured.

The cures were obtained from the following lines of treatment:—

Copper Sulphate	...	5	Kurchi	...	...	...	2	} All in original try out.
Santulin	...	...	3	Quinine Enemata	...	...	2	
Bismuth and Calomel	...	2	Santonin	...	...	...	1	
M & B 693	...	...	5					

After-effects.—In the 140 series only two cases of liver abscess, one fatal, were noted and none of the cases could be ascertained afterwards to have had this nor is it likely as according to Osler the usual period for development is within two months. Several cases of hepatitis were noted. One case perforated and died and one case died of an acute ascitic crisis. No other surgical complications were noted.

Treatment at Nakom-Paton.—This hospital was designed to clear all the serious and chronic sick from Thailand and Burma. Starting in February 1944 it was built and full by August 1, 1944. Its maximum figure was 6,666 of which some 1,200 were amoebic dysentery cases. These were nearly all cases who had attained the chronic stage. During the first few months no emetine was available but when the dysentery wing opened in August with some 1,200 amoebics, and which the writer commanded, emetine was grudgingly handed over by the Japanese from their own and Thailand Red Cross Stores (mostly the latter) in sufficient quantities to issue life-saving but not curative doses to bad cases and new cases as they occurred.

Under these circumstances experimentation was not justified, but other available drugs to eke out emetine were used when they came to hand. Such drugs were stovarsol or spirocid, copper sulphate, carbasone, M & B, etc. The other drugs mentioned under Kanchanburi were not available.

In addition some attempts at extra diets and vitamin products were possible. We were, however, severely handicapped by very spasmodic quinine issues and atebirin supplies so that malaria overshadowed all our cases and interfered with treatment. However, by these means after August 1 the death-rate from frank amoebic dysentery was negligible.

Surgery.—In the early stages before emetine was available, two more appendicostomies were performed for the writer by Capt. J. Marcovitz, *M.B.E.*, *R.A.M.C.* They were both astonishingly successful—one, a chronic case had dragged on with six to eight stools a day for a year. He had previously had a little emetine only. Immediately after the operation his stools returned to one daily. He then had saline washouts and two courses of CuSO_4 as already outlined. This case was allowed to close after three months. Since then he had no further symptoms and nine negative stools. He was a *R.A.M.C.* serjeant and remained on the staff of the hospital till V.J. Day. He never looked back. He was undoubtedly completely cured. He had no emetine since the operation.

The second case, a private in the Argyle and Sutherland Highlanders, had a similar history but had never had emetine. He had rather a stormy passage after the operation, his stools increasing—but in due course he settled down under the same treatment as the first case (with the addition of three initial washouts of $2\frac{1}{2}$ per cent yatren). When emetine became available he did not need it and proved ultimately completely cured with nine negative tests and was working as a volunteer masseur in the hospital when V.J. Day arrived.

When emetine arrived surgery did not seem further justified but cases occurred in which emetine brought no relief and a conference of physicians and surgeons was called to consider whether surgery was justified in these so-called emetine resistant types of cases.

The chief surgeon, Lt.-Col. A. E. Coates, *A.A.M.C.*, favoured ileostomy—so did the Dutch surgeons. Others favoured appendicostomy. The points for ileostomy were that this operation completely rested the large bowel, the points for appendicostomy were curative and soothing lavage. Against ileostomy was the difficulty of nursing such cases under existing circumstances and the fact

that two operations were necessary—one to open, one to close. Furthermore if appendicostomy was a failure one could always proceed to ileostomy.

Both types were carried out, however, ileostomy by Lt.-Col. Coates and appendicostomy by Lt.-Col. E. E. Dunlop, A.A.M.C. (see *B.M. Journal*, January 26, 1946), with very satisfactory results.

The subject was also fully reported to South East Asia Command, and in the hospital records and war diaries—it will no doubt appear in time in the Official History of the War (Medical Services).

Conclusions drawn by the writer in the above reports were as follows:—

- (1) In the absence of specific drugs appendicostomy is of the greatest value in amœbic dysentery.
- (2) Therefore in cases of emetine resistance there would seem to be a similar case for appendicostomy.
- (3) In cases of severe chronic colons from dysenteries of any nature and in cases left too late for appendicostomy there seems a definite field for ileostomy.

On emerging from captivity into civilization, however, one was confronted in this connexion with the writings of Hargreaves.

Writing in the *Lancet*, July 21, 1945, Hargreaves points out that emetine resistance in any strain of *Entamœba histolytica* is as yet unproved and there is no scientific evidence to support it.

He states that refractory cases of amœbiasis will nearly always clear up under emetine and emetine bismuthous iodide after initial treatment with penicillin and sulphasuxidine to rid the patient of the secondary infection. He also points out that E.B.I. must be used in powders and not as compressed tablets or keratin coated capsules—the powders uncompressed can be put up in gelatin capsules or cachets. He finally states that such treatment by penicillin and sulphasuxidine has been satisfactorily applied to ulcerative colitis.

In our cases in Nakom-Paton—the delaying tactics of secondary infection were well realized and in obstinate cases this was always tackled first by sulpho-namides. E.B.I. when obtainable was also used correctly. Of course we had no knowledge of penicillin in P.o.W. Camps. Many stated that the good effects of M & B 693 mentioned by the writer were entirely due to elimination of secondary infection—though this does not explain the cure of the actual amœbiasis as well.

Paragraph 2 of the writer's conclusions on surgery might be rewritten therefore as follows:—

“In cases of apparent emetine resistance where all other treatment fails, there would appear to be a similar case for appendicostomy.”

As regards ulcerative colitis, it might be mentioned that cases are still occurring where in spite of treatment along Hargreaves' lines no improvement is seen. There would appear to be a field here for appendicostomy, too.

With final reference to emetine resistant and different strains of *Entamœba histolytica* the conclusions of Brumpt are of interest.

Commenting on the difference between carrier rates and notifications of amœbic dysentery and its mortality rate in certain countries in Europe and

the Philippines, he states in his *Précis de Parasitologie*, 5th edition, that there must of necessity be therefore different strains of *Entamœba histolytica* varying in pathogenicity. He has experimented on kittens and found proof of this.

Wenyon, however, in his *Protozoology* disputes this and argues different susceptibility and resistance powers in the kittens used.

Nevertheless Wenyon himself states that *Entamœba histolytica* with small cysts cannot be proved pathogenic.

Westphal as has been mentioned considers many amœbæ lie latent until some intercurrent infection of the bowel gives them a chance to get active.

There are many arguments for and against different strains, pathogenic, non-pathogenic, emetine resistant, etc. The experiences in this thesis do suggest different types of virulence although individual powers of resistance cannot be overlooked.

In December 1944 the Japanese decided the hospital was too large and that some "fit" men would go to "*Convalescent Camps*"—(the italics become obvious later). The dysentery wing came severely under the axe owing to the apparently fit appearance of many of the "chronics." Before this blow fell and in preparation for it after warnings—on the advice of Major W. E. Fisher, A.A.M.C., the consulting physician, a survey of all dysentery patients was undertaken. Of 207 of the writer's personal patients the following facts emerged:—

All the cases had originally been sent down as positive and reasonably ill, otherwise the Japanese would not have permitted their admission. They all arrived at the end of May 1944. At the end of November 1944, out of 207, 88 had not needed stool examinations during this period. It should here be mentioned that owing to shortage of Staff and equipment (even when the hospital was full we only had one microscope and the part-time use of another) it was only possible to examine the stools of new and undiagnosed cases and those whose symptoms urgently demanded it. Eighty-eight then had not had any suggestion of flare up of the disease or passage downhill. Of the remaining 119, 41 could be classed as "condition good" and 39 as "condition fair." The remaining 39 cases were still serious. Forty-three cases received life-saving emetine doses during this period. Three cases of the original 210 under the writer's personal care died during this period. The death-rate in the rest of the wing was proportionate.

In other words, of a series of 207 cases who originally attained chronicity, only 43 relapsed sufficiently to require treatment. This shows the importance of our early efforts to get the patients over the acute and bad stages to one of chronicity.

These facts were not unobserved by the Japanese—furthermore, the chronic amœbic during his quiescent periods had a very—and quite false—marked appearance of well being—consequently a considerable drive for "deportations" was made on the dysentery wing. Owing to the promise of *Convalescent Camps* we were more worried about spreading the disease than for the fate of the actual patient. In point of fact we might have well been worried by both—all the patients discharged from the hospital with the promise of Con-

valescent Camps were sent straight to heavy work—many to the notorious Tenasserim road from Prachuab Kerikan to Mergui.

Many arguments were put to the Japanese who finally agreed to a test of all amœbics but if they had three negatives they must go out. Here again as has been pointed out, present or recent symptoms were overlooked. This test of infection seemed to satisfy the Dutch but not the British and Australian. We finally persuaded the Japanese to accept not less than six negatives. About 30 per cent proved positive in these tests. The dysentery wing was therefore cut down to about 800. Later it was cut down even more—even cyst carriers finally being sent out, and the wing would probably have vanished as such if peace had not come, at which time the wing, no longer under the writer's control, had shrunk to about 350 amœbics.

PROPHYLAXIS AND PROGNOSIS.

This may seem an unusual linking of two headings—but conditions in Thailand, especially in the later stages, made the one to a considerable extent dependent on the other.

The prognosis of untreated or semi-treated amœbiasis varies to a great extent with the severity of the disease, but the figures in the 140 Kanchanburi cases show what to expect in an untreated epidemic of this sort.

But what is to be the ultimate fate of the chronics and old amœbics released on cessation of hostilities? Will time eradicate the disease or will they be permanently carriers unless put through a rigorous course of clearance treatment?

Some authorities stated that we were all infected—but a test check on 30 patients taken at random from the tuberculosis ward at Nakom-Paton who had not had or were not aware that they had had amœbic dysentery showed 18 per cent to be cyst passers. Twelve stool tests were done in each case and it is of interest that the most positives were found on the fifth and eighth tests.

In addition to a presumptive figure of 18 per cent for all prisoners we have those who have had the disease and who have not been properly cleared. The writer considers that in all 40 per cent of the whole force returned to their homes as cyst carriers. Only those who gave symptoms can have had hospitalization and exhaustive treatment and stool tests. It would be of interest to know how many are turning up. In the weekly Public Health Laboratory Returns nearly each return contains one case of amœbic dysentery from "P.o.W. ex Far East" or "Soldier returned from Far East." This will presumably continue.

That the disease is self-limiting as far as symptoms go there seems little doubt but is this a cure or is the patient merely living in harmony with his parasites? If a cure, then neither emetine nor any other drug can be labelled a specific—for surely the milder the case the sooner the self-cure.

It is safer to assume that the person in these conditions remains a carrier until properly treated and really cured. As has been stated before, cases are constantly cropping up of old amœbics flaring up years after the original

attack, and that with little or no chance of having been reinfected. Westphals theory may well operate in these cases as in the "innocent" cyst carriers and a bowel infection cause the amœbiasis to flare out again.

Prophylaxis in the earlier days at Kanchanburi Hospital had a very definite aim. This was (1) to segregate the known amœbics and prevent spread; (2) to prevent an epidemic *per se*.

The amœbic patients were isolated and their food-containers kept separate and only used for them. Their small purchases from the canteen were done by proxy—they were not allowed to sit at the canteen tables and rap their cyst contaminated finger-nails in the pools of spilt coffee and tea on the surface when demanding service—for the Chinese or Thai boy would be sure to deposit the next customer's rice cake or biscuit into one of the aforementioned pools and the tables were rarely cleaned!

Separate latrines were provided for amœbics. All water was boiled in the hospital. No men who had ever had amœbic dysentery were allowed to work in or enter the cookhouse. Those who had had bacillary dysentery were excluded for three months.

Attendants in the amœbic wards were given minute instructions on how to avoid contamination and infection.

Periodic examinations of cookhouse personnel for cysts were carried out. New employees had to have three negative stool tests—not enough, undoubtedly, but it had to serve *faute de mieux*. All cases of diarrhœa amongst cookhouse personnel were ordered to report at once for stool tests. Every effort was made to keep down flies.

Such methods were not possible in Nakom-Paton. The size of the camp and the presence of 1,200 amœbics militated against them. The Japanese although persuaded to let us have a separate dysentery block would not permit a separate canteen. Attempts to make the patients avoid the canteen and buy from an itinerant canteen official broke down, it was impossible to keep supervision. Separate cooking and eating arrangements were, however, possible—separate latrines were provided. The usual attempts to keep the disease out of clean blocks were put into force and all cooks and cookhouse personnel periodically examined.

So many had the disease by now and so many appeared on the surface to be comparatively happy with it that the fear of it seemed to vanish from the free and from the amœbics themselves. The latter ceased to regard themselves as a danger to others. The Japanese did not help and it is regretted that many who should have known better began to regard precautions as bunkum and to disregard orders. This in turn led the Japanese to consider amœbics as a nuisance, not worth protecting and as avoiding work on the grounds of untouchability and, as has been already mentioned we had great difficulty in preventing amœbics being spread over the camps—the six stool test before discharge kept this tendency at bay for some time—but towards the end even cyst carriers were being sent out.

If, as many regarded, these cases were curing themselves then prophylaxis was becoming less necessary—but this had not and has not been proved.

Lastly, in the excitement of release, precautions went to the board and it was well nigh impossible to keep amœbics apart and indeed in repatriation schemes no such attempt seems to have been made, but it must be remembered that as the men got nearer home, more civilized conditions and hygiene predominated and time alone can tell if the disease rate in U.K., Holland, Australia and elsewhere will be increased.

CONCLUSIONS.

Amœbic dysentery is a disease which can assume epidemic proportions with many varying degrees of severity, ranging from very acute fulminating types to extremely mild ones.

There seems evidence that there may be different strains of *Entamœba histolytica* with varying pathogenicity and resistance to emetine.

Whilst emetine and its derivatives are specific for the disease, other drugs notably bismuth subnitrate, certain arsenicals, M & B 693, and copper sulphate have an ameliorating and occasionally curative action, even in most disheartening conditions of diet and hospitalization.

Surgery seems to have a definite place where all drug efforts have failed. Appendicostomy or cœcostomy should be tried before ileostomy is resorted to.

There would appear to be a field for appendicostomy or cœcostomy in common ulcerative colitis which has defied medical treatment, judging from results in amœbic ulcerative colitis.

The symptoms of amœbic dysentery certainly abate and the condition limits itself once the patient has been brought safely to the "chronic" stage. There is no proof, however, that the disease completely cures itself with death of or removal of the parasite. It is considered that the average standard of cure is not stringent enough to make a case for self-limitation of the disease fool-proof.

SUMMARY.

A study of the development of a severe epidemic of amœbic dysentery amongst Allied prisoners of war in Thailand is presented.

The disease is described "in the raw" without proper treatment. Efforts at treatment without emetine or its derivatives or with insufficient doses are recorded. A series of 140 cases so treated are described with their outcome.

Surgery's place in amœbic dysentery is discussed and results reported.

Differential diagnosis is gone into.

A further series of 207 chronic patients is dealt with showing their progress with only life-saving doses of emetine.

The question of the self-limitation of the disease is discussed, with debate on standards of cure and clearance.

Such questions as emetine resistance and prophylaxis are touched upon.

Conclusions on these unusual treatments and aspects of amœbic dysentery are appended.

Finally the writer would like to put on record the excellent work done by Medical Officers and Orderlies alike who worked with him and to thank them for their efforts. He would also like to thank, personally, the following

for advice, help, and encouragement in three and a half very bleak years—Lt.-Col. J. W. Malcolm, *O.B.E.*, *M.C.*, Capt. J. Street, Capt. J. Marcovitz, *M.B.E.*, and Capt. W. Privett of the *R.A.M.C.*, Lt.-Col. A. E. Coates, Lt.-Col. E. E. Dunlop and Major W. E. Fisher of the *A.A.M.C.* and Major R. W. de Soldenhoff of the *I.M.S.*

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POSITIVE HEALTH—ITS ATTAINMENT IN THE SOLDIER AND THE ARMY'S CONTRIBUTION TO IT IN THE CIVILIAN.

**A Chadwick public lecture delivered by Brigadier A. E. RICHMOND,
C.B.E., K.H.S., on October 7, 1947, at the Royal Society of Tropical
Medicine and Hygiene.**

It is my privilege to talk to you about positive health—its attainment in the soldier and the Army's contribution to it in the civilian.

I know that some of you will be asking what the term "positive health" implies; others will be cogitating as to whether there is real justification for the use of such a term at all.

In attempting to frame a definition I know I am rushing in where angels fear to tread. I feel, however, that although I cannot produce a perfect definition it is possible to frame one which will explain reasonably well what is meant. I present you accordingly with the following, acknowledging at the same time my indebtedness to Professor Ryle for certain of the phrases used.

Positive health is attunement to surroundings, combining with vigour, balance, and efficiency, and with the adequate co-ordination of mental and physical function to produce a harmonious integration with environment, confidence and satisfaction in work, recreation, and leisure, and a capacity for effectiveness of essential relaxation and rest.

Turning now to justification for the use of the phrase, I was much exercised up to a very short time before coming here as to how best to obtain your sanction for the use of the term "positive health." I decided that a simple practical example drawn from everyday life might help matters considerably and I found such an example this morning after it had occurred to me that an examination, superficial admittedly, of my fellow passengers in a twenty-minute bus journey might afford the justification that I required. I observed some three dozen people altogether, and of these, in my view, only three possessed positive health in full degree. One of these was the bus conductor whose healthy appearance, mental and bodily fitness, alert attitude, extroverted outlook, interest in his passengers, obvious happiness in his job all pointed to a man possessed of true positive health. He exuded an atmosphere of well-being and was a clear asset to the community. The second was a little old lady taking her granddaughter out for the day. Her alertness, vivacity, general attitude of cheerfulness, her interest in everything that she saw, her healthy appearance in spite of her age and in spite of the loss of one arm, were all qualities which with others went to make up a manifestly healthy individual. The third was a young man with a squash racket and bag, whose glossy hair, open colourful face, good bearing and posture, alertness, and obvious first-class integration with his environment pointed to true positive health. This was further confirmed when he left the bus by his co-ordinated movements and air of confidence, and of general satisfaction with life.

In no others of the three dozen individuals I have referred to did there appear to be any real approach in degree of health to the three I have specially mentioned. They were walking so it seemed to me in that no man's land of negative health which lies between the green pastures of positive health and the arid deserts of disease and moreover did not in many cases realize it.

I am sure you will agree that while so many of our people are passing their lives in this no man's land and are in so many cases quite unconscious of it, and while there is such a wide gap between positive health and disease there is every justification for the use of the term "positive health." There is special justification in the case of the Services where positive health means everything to the efficiency of the Navy, Army or Air Force as the case may be.

I must apologize for quoting again the oft-mentioned statement by Disraeli, but it is of such importance that I must do so. It is "The health of the people is really the foundation upon which their happiness and all their powers as a state depend."

Health is undoubtedly the corner stone of happiness and of a useful life whether individual or communal and there is unfortunately at the present day a material lack of appreciation of this truth. There is, therefore, an urgent need for increased health education and improved facilities for practising the principles of health.

Popular apathy has unfortunately been encouraged in the past by the medical profession which has been far too apt to walk in the gloomy vales of disease and to fail to raise its eyes sufficiently to the sunlit slopes of positive health. There has in fact been too little study of positive health and its symptoms, signs and results, and also of its achievement, maintenance and enhancement.

I hope I have said enough to indicate its great importance in civil life.

As far as the Army is concerned, and for the matter of that the other two Services, a maximum degree of positive health is essential. Campaigns may be lost in the earliest days if the Army is not trained to the highest possible pitch of efficiency. Such training is impracticable without the highest possible standards of mental and physical health and a minimum of disease.

Field-Marshal Montgomery has said that high morale is essentially the ability to triumph over all difficulties, dangers and discomforts and to get on with the job. It is not contentment, fitness, healthiness or toughness. Nevertheless mental and physical health is of the greatest importance to it, and from this aspect as well as from many others they must be cultivated to the full.

Our most important consideration as far as the Army is concerned is clearly the National Service man, and in view of the short period of time that he is with the Colours, that is to say one year, it is manifest that there is urgent need for speed and efficiency in the health education of the individual recruit, both as to what he can do for himself and others, and as to what can be done for him from sources outside himself. His proper instruction in the art of health is essential and with adequate training of this kind then the greater the value to the individual and to the Army of the technical military training given; also of the individual as a trained soldier and later as a combined soldier and civilian in his Reserve Service and finally as a civilian.

I now want to give you some indication as to the state of health of that younger section of the population which comes before the Ministry of Labour and National Service boards under the existing legislation in connexion with compulsory service.

My lecture is on the subject of positive health and you will naturally wish to have information as to the degree to which positive health is present in the section of the population with which I am going to deal.

I must make it quite clear that this information cannot be given because in the first place we do not really know what positive health is and in the second place no scientific methods for assessing it have up to the present been formulated or tried out. I am consequently in the position of only being able to give you statistics indicative of the existence of actual disease in greater or less degree in the civil population called up for service.

MINISTRY OF LABOUR AND NATIONAL SERVICE BOARDS

GRADING OF MEN CALLED UP FROM 8/6/39 TO 27/3/47

TOTAL 5,697,475

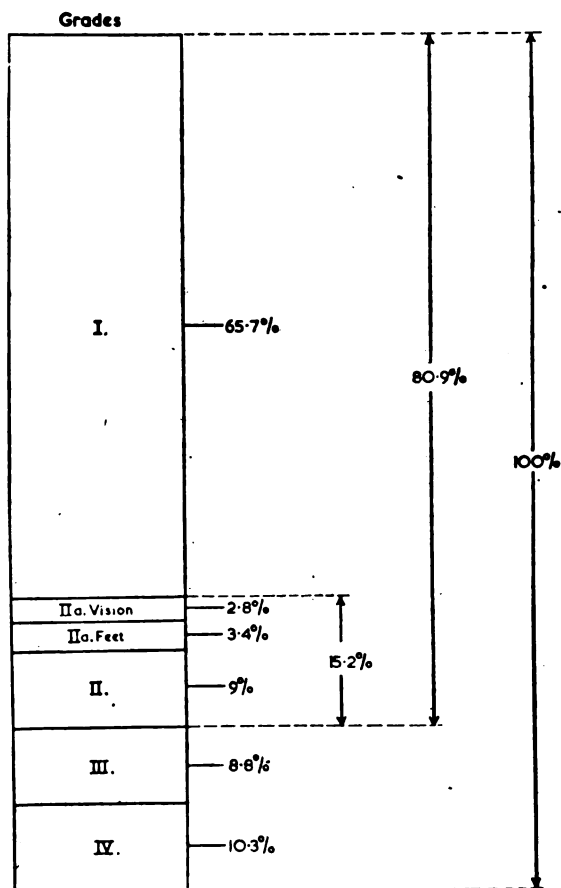


CHART 1.

My first chart gives information as to the numbers of individuals in the various grades used by the civilian medical boards of the Ministry of Labour and National Service and you will note that the figures cover some 5 million or more men who have come before the boards in the course of the past few years.

Before discussing them further I would stress again that they apply to a selected group of the population as regards age, also that the figures do not include quite a large number of men who were obviously unfit for service owing to the loss of limbs or for other reasons and who do not come before the civilian boards referred to at all. I know too that when you have looked at the statistics produced for you, you will ask for comparative figures for say the 1914-18 period. I regret to say that no really comparable figures exist and I am therefore unable to give you any information of this kind.

Turning to the chart I do not want to waste a lot of your time in going into the matter in detail. In the summary you will see that 2 men in every 3 were found to be in Grade 1. This means that they had full normal standards of health and strength and were capable of physical exercise suitable to their

MINISTRY OF LABOUR AND NATIONAL SERVICE BOARDS

CAUSES OF REJECTION OF MEN CALLED UP
SAMPLE OF 60,000 MEN BETWEEN 1939 AND 1942

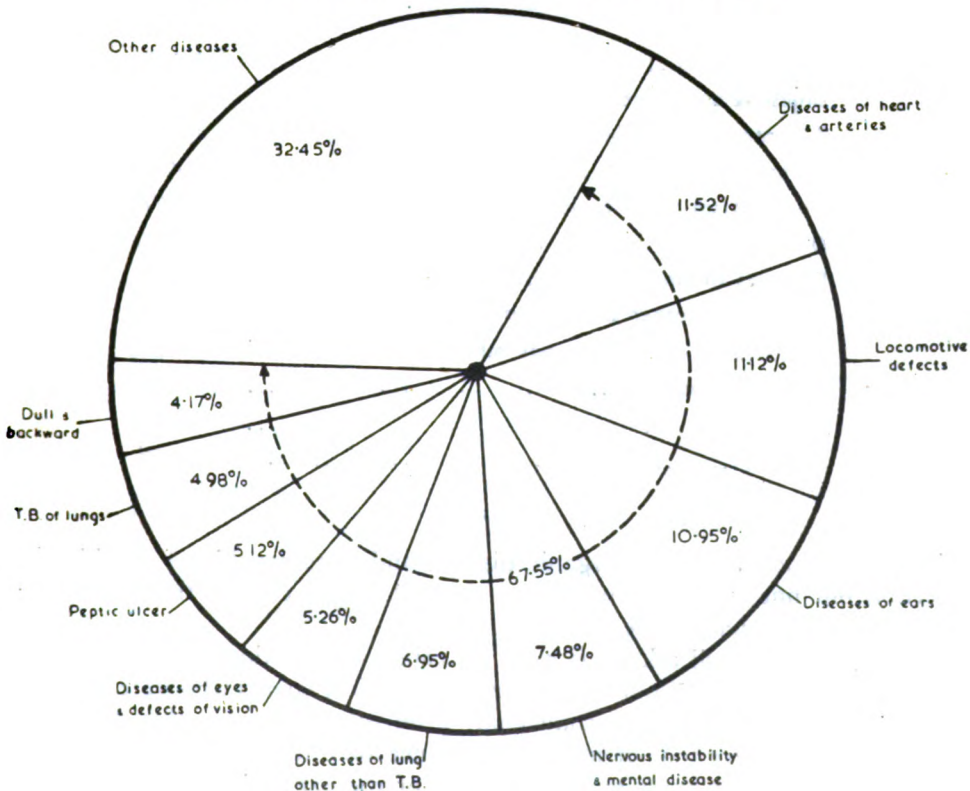


CHART 2.

age as also of undergoing severe strain. They would, however, in a proportion of cases have been suffering from minor remediable defects.

Approximately one in three are not fit for Grade I, and you will observe that one in five, in other words approximately 20 per cent suffered from marked disabilities or showed evidence of past disease, and were fit for Grade III only or were unfit for any form of service at all. The last-mentioned category accounted for about 10·3 per cent of all those coming up for examination.

Fit for Grade II only, that is to say, those who were not fit for Grade I, but

MINISTRY OF LABOUR AND NATIONAL SERVICE BOARDS

CAUSES OF REJECTION OF MEN CALLED UP (*continued*)

Analysis of "other diseases" referred to in previous slide:—

Diseases of veins.	2·88%
Defects of arms.	2·33%
Diseases of urinary tract... ..	2·12%
Hernia... ..	2·00%
Diseases of organic nervous system.	1·95%
Spinal deformities.	1·83%
Epilepsy... ..	1·81%
Skin diseases... ..	1·74%
Digestive diseases other than peptic ulcers.	1·67%
T.B. other than pulmonary..	1·50%
Defects of hands.	1·48%
Rheumatism & bone diseases.	1·17%
Diabetes..	0·95%
Diseases of thyroid... ..	0·57%
Deformities other than spinal.	0·52%
Diseases of ductless glands other than thyroid.	0·50%
Blood diseases.	0·29%
Enuresis... ..	0·24%
Others... ..	6·90%

CHART 3.

who showed no progressive organic disease, and were capable of considerable exertion but not of undergoing severe strain 15·2 per cent of the whole, that is to say, approximately one in seven.

You may now well ask what were the causes of rejection in those 15 to 20 per cent of men coming up before the civilian medical boards who were regarded as not fit for service. The second chart gives information in this connexion and you will observe that of major importance were diseases of the heart and arteries, defects of locomotion and diseases of the ear and each of these contributed about 10 to 11 per cent of the rejections. These three main groups,

therefore, were responsible for something like one-third of the rejections. Nervous instability and mental diseases, coupled with the dull and backward cases comprised 11 to 12 per cent of the rejections, while tuberculosis 6.5 per cent (including 5 per cent T.B. of the lungs) added to other lung diseases—7 per cent—was responsible for 13 to 14 per cent of the rejections. Finally peptic ulcer and diseases of the eyes and defects of vision at 5.1 per cent and 5.3 per cent of rejections respectively were the next most important groups.

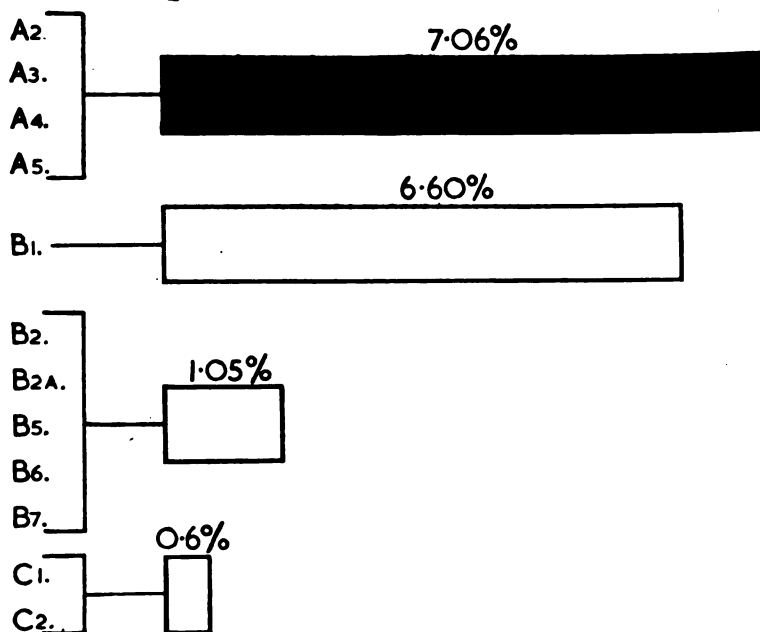
In my third chart you will see details of that large category shown as "other diseases" in the chart previously exhibited.

I now propose to afford you similar information as to the material that

ANALYSIS BY MEDICAL CATEGORY OF A SAMPLE OF 5169 RECRUITS TAKEN RECENTLY INTO THE ARMY

Category A1. ——— 85.24%

Remaining 4.76% made up as follows:—



Note 4.7% of the whole sample had defects of locomotion.

CHART 4.

becomes available to us in the Army, and the chart illustrates the sub-division of Army recruits according to medical categories.

You will observe 81.2 per cent are A1 and that 7.06 per cent are in the other A groups; i.e. roughly 92 per cent of the whole come into the A category. They can undergo severe strain, but minor remediable disabilities, slight defects of

locomotion, as also small defects of vision may be included in these A categories. In the B categories we have a total of about 7.6 per cent of the whole. Those in the B categories are capable of considerable exercise not involving severe strain. There are, you should note, special subdivisions of the B categories reserved for those who are fit for higher categories but suffer from bad hearing, or who have marked defects of locomotion.

The numbers in the C categories are small indeed. These categories include only those who are fit for home service or limited employment abroad, or for home service only.

The figures I have given you are recent and cover a total of some 5,000 recruits in our Primary Training Centres.

As the chart indicates, something like 4.7 per cent of our recruits suffer from defects of locomotion and these when added to the rejections by civilian medical boards on this account give a total of about 6 per cent of the men coming before civilian medical boards with defects of this nature.

I would add as perhaps rather an important point that 3.5 per cent of our recruits need some psychiatric reservation on their employment.

You may well ask what are the primary causes on account of which recruits are category B, and my next chart gives you information on this subject. Of much the greatest importance are general defects of physique, which you will observe account for 48.2 per cent of all the B category personnel that come to us. This is a high figure and you may take it that something like 3 per cent

ANALYSIS OF THE PRIMARY CAUSES OF RECRUITS BEING IN CATEGORY B

GENERAL DEFECTS OF PHYSIQUE AND CONSTITUTION 48.2%

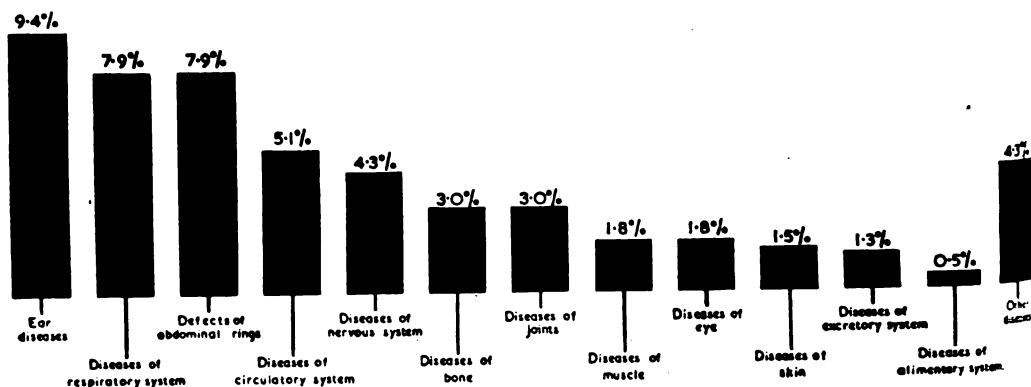


CHART 5.

of all our recruits come into this class. It is impossible to state an accurate figure for the civilian group in general that we are considering, but with a rejection rate of 15 to 20 per cent it is pretty clear that something like one in ten are in the general category comprising defects of physique and constitution.

Referring again to the chart you will note that diseases of the ear, of

the respiratory system and of the abdominal rings are responsible for a comparatively large proportion of B category recruits.

Time does not I am afraid permit of further comments on the figures I have given you.

I would emphasize once again that I have produced no satisfactory evidence as to the positive health of these groups with which I have dealt, and I have indicated rather the prevalence of frank disease.

From the statistics provided, you will have to infer the state of affairs as regards the incidence of positive health; your inference is likely to be that with such large proportions of our people suffering from frank disease or disability the lack of positive health is likely to be material.

I would now ask you to consider for a few minutes the matters of personnel selection and medical categorization.

The Army's man-power requirements are so large as clearly to preclude all our troops being in category A1. Lower categories must therefore be accepted depending in amount on the man-power situation and increasing acceptance of these is necessitated as a long-continued conflict makes progressively further calls on the man-power of the nation.

Modern warfare too makes ever greater demand upon the men themselves. A high degree of physical capacity varying with the nature of the employment of the individual is essential as also an increased level of intelligence to allow of the grasping of the applications of technical science and organization. Temperamental stability also is of increasing moment in the conduct of a soldier under war conditions.

The maintenance and enhancement of the health of the normal, and also of the subnormal individual are materially affected by the nature of his employment and by its suitability to his qualities. Adequate selection, therefore, coupled with an efficient scheme of medical categorization are a primary necessity if maximum success in fitting the man to the job is to be achieved.

Selection and medical categorization were given detailed study and attention during World War II with the most satisfactory results.

As regards selection, this is done by means of questions and tests. The form to be filled in includes the recruit's identification particulars and his standard of education, according to a numerical code, with special reference to specialization in scientific, mathematical and technical subjects; information as to particular experience such as driving, handicrafts, use of wireless, etc.; the results of intelligence tests which place a man in what are known as selection grades one to five, these grades expressing general intelligence and mechanical and verbal aptitudes; potentialities as a tradesman; combatant temperament and capacity for leadership. With this complete picture the personnel selection officer is able to make effective recommendations for employment and as a result of this procedure there has been during the recent war and since a great saving in man-power, and an improved attainment of positive health.

As regards medical categorization, a system by which functional capacity can be estimated is of the greatest moment. Such a system too is an obvious step towards the assessment of positive health.

PULHEEMS, of which you will understand the meaning in a few moments, is a method of medical categorization which was originally introduced into the Canadian Army. It classifies functional ability and correlates this with any anatomical or other abnormality. It was not, for various administrative reasons, adopted in the British Army during the war but steps were taken immediately after the war to form an Inter-Services committee with a view to producing a system of medical categorization which would be applicable to all three Services. As a result of the deliberations of this committee, the PULHEEMS system was recommended for use and it has now been accepted by the three Services.

As far as the Army is concerned it is due for introduction administratively on January 1, 1948, and will embrace also the Territorial Army.

There is considerable interest in this system outside the Services on the part of big organizations employing much man-power. It is of obvious interest to the Ministry of Pensions from the point of view of assessing degree of functional disability. From the point of view of health surveys of native populations, the system has obvious applications in the work of our Colonial Medical and similar services elsewhere. It is understood also that a number of our universities are now including the system in their medical curricula while in certain cases students in universities are being pulheemized with a view to statistical health research among them.

It is important that I should now explain to you the meaning of the term PULHEEMS. This is best effected by means of the chart now in front of you, and you will observe from the first table that the PULHEEMS assessment in general conforms to degrees of fitness and that these are relative to climatic restrictions as shown.

The subdivisions of PULHEEMS are indicated by the letters which go to make the name and are as follows:

- P — Physical capacity, this being a combination of physique and stamina. Muscular development is taken into account as also age, height and weight and their correlation and in addition the ability to acquire stamina.
- U — Upper limb. In assessing functional ability in this connexion, strength and of movement of the upper limb, the general efficiency of the upper arms, shoulders, girdle and neck all have to be considered.
- L — Locomotion. Here the strength range of movement and efficiency of the feet, legs, pelvic girdle and lower back are all important.
- H — Hearing is assessed in numerical degrees 1 to 8 and varies from very good to marked defect. The degrees 4, 5 and 6 which indicate service in temperate climates only, are not used in connexion with hearing.
- EE — Eyesight. Under this heading information is given as to the uncorrected and corrected vision in each eye, by means of numerical degrees varying from 1 to 8. Degree 1 equals vision of 6/6 and 8 indicates less than 6/60.
- M — Mental capacity. This is the ability of the individual to understand his duties as a soldier. It has a wider concept than the intelligence tests, the results of which are shown in the selection grade (1 to 5) of the man. To arrive at an assessment of mental capacity, the selection tests and the selection grade awarded to the man, his record, and his impression on interview are all taken into account. Here again degrees 4, 5 and 6 are not in use.
- S — Emotional stability. This indicates emotional fitness. Here degree 1 is not in use, but degrees 2 to 8 are employed.

In addition to the subdivisions just detailed you will notice on the PULHEEMS profile the letters CP. These refer to colour perception and there are four subdivisions depending on the results of the colour vision tests applied.

For every trade and occupation in the Army, to say nothing of the different Arms and Corps, minimum standards are obviously necessary and, to give you an example, the minimum standards laid down for two trades in the Army are shown in the chart.

ASSESSMENT OF THE QUALITIES P.U.L.H.E.E.M.S.

Degree	Functional Efficiency	Climatic restrictions
1	Above average	None
2	Average	
3	Moderate functional defect	
4	As P1	Temperate climates only
5	As P2	
6	As P3	
7	Marked functional defect	U.K. only
8	Permanently unfit	—

Example of a PULHEEMS Profile.

Year of birth	P	U	L	H	E	E	M	S
1920	3	2	7 [●]	2	3	4	2	2
					1	2		
Ht. 72	P							
C.P.I	U							
Wt. 193	L	Severe Pes Cavus with Hallux Rigidus						
	S							

● Authorised to wear shoes

Examples of Minimum Standards of fitness

Trade	P	U	L	H	E	E	M	S	Ht.	Wt.	C.P.
R.E. Electrician	2	2	3	2	8	8	2	2	64	120	3
					3	3					
R.A.M.C. Nursing orderly	3	2	3	2	8	8	2	2	60	100	4
					5	5					

CHART 6.

I now propose to tell you something about the methods employed by the Army in the attainment of positive health and I would like first to talk about the substandard recruit.

This type of recruit comprises the boy who is not up to standard due to poor physique or lack of development, or to malnutrition, or possibly to abnormalities which have resulted from postural, occupational, environmental or other origins.

The problem of the substandard recruit was a big one prior to the war and in 1936 a physical development centre for dealing with this type of individual was provided at Canterbury. Another centre of this kind followed shortly at York.

In the earlier stages of World War II it was obvious from the proportion of men gravitating into the lower categories that there was a strong incentive for pursuing a similar policy and a centre for 400 men was set up in July, 1942. Ultimately we had three centres and these dealt with something like 35,000 men during the course of their existence. Of the first 4,000 who attended physical development centres approximately 81 per cent were raised in category and of these 69 per cent were brought up to category A1. Of a recent sample of 2,000 men examined it has been found that 75 per cent remain in category A1 after two years. I am sure you will agree that these are excellent results.

We now have one centre at Chester which caters only for the recruit who is a potential A1 soldier. It has a capacity of 1,800 trainees and deals with some 10,000 men annually. The length of the course is eight weeks and there is a special selection procedure at Primary Training Centres by which only those men who are really suitable for this special course are sent to attend it.

The principles governing the organization of a physical development centre are in the main classification into disability groups, treatment to improve individual functioning and performance, and full facilities for physical recreation and for educational development of the trainee.

The groups into which trainees are divided are chiefly:

- (1) Malnutrition and under-development; (2) postural abnormalities;
- (3) defects of the feet; and (4) other locomotor and miscellaneous defects.

Considerable emphasis is placed on the need for the co-operation of the man and for the use of his intelligence. Medical supervision is effective and is exercised on physical training, individual remedial exercises, physiotherapy and recreational training, while much attention is paid to dietetic requirements, and education in the shape of debates, discussion groups and similar activities.

During the course tests of progress are carried out and on its completion medical categorization is arranged for.

Approximately 8 per cent of the recruits coming into the Army require a course of the nature of that given at our physical development centre, and I think it may be said that the capacity of the latter is adequate to deal with all these young men.

I feel I must point out that work of the kind performed at our physical development centre is really a responsibility of one or other of the civil Ministries inasmuch as it should be ensured that youths of the nature referred to now dealt with by the Army at the age of 18, should be given the requisite special attention at an earlier age.

It has not been possible up to the present for either of the Ministries of Education, Health, or Labour and National Service to undertake this responsibility and until it can be assumed by one of them, preferably the Ministry of Education, the Army must continue to carry out this essential work.

I would like to draw your attention to the two sets of photographs displayed

(figs. 7A and 7B) which indicate the results obtained in recruits sent to the physical development centre and which are typical of thousands of recruits who pass through this centre.

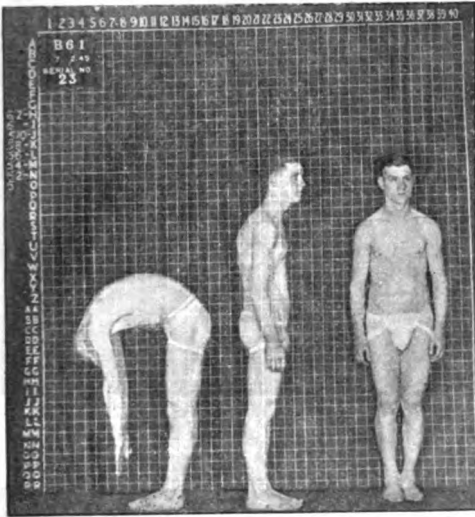


Fig. 7A.

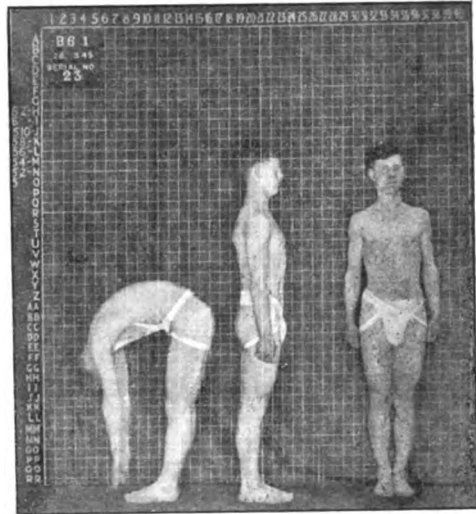


Fig. 7B.

In the first group you will see an individual on admission and will note that he is short of stature, under weight, with forward neck and shoulders and short hamstrings.

In the second you see the results of the course in improved posture, mobility and general physique and a weight increase of eight pounds.

The second set of photographs (figs. 8, A-1, A-2, B-1, B-2, p. 286) show a recruit who was, on admission, rather over weight with a long dorsal kyphosis and forward shoulders with diminished feline angle. You will observe the result of training in his marked improvement in posture and mobility coupled with loss of weight of some three pounds.

We should now turn to a consideration of the Army's methods in connexion with the training of the ordinary recruit.

As you well know changes are impending on account of the reduction of national service to one year with the Colours only. Though these changes are imminent the existing policy from the point of view of health training will be followed as far as is practicable, and I would like to tell you something about those factors in such training which we consider to be of particular importance from the point of view of the positive health of the individual and of the community.

Firstly drill! There are, I dare say, some of you who think drill cannot possibly have much influence on positive health. This impression is incorrect, and there is no doubt that drill apart from teaching obedience, cohesion, precision, and orderliness inculcates self-respect. It is also of great moment in the training of the soldier in correct body carriage and its maintenance. The

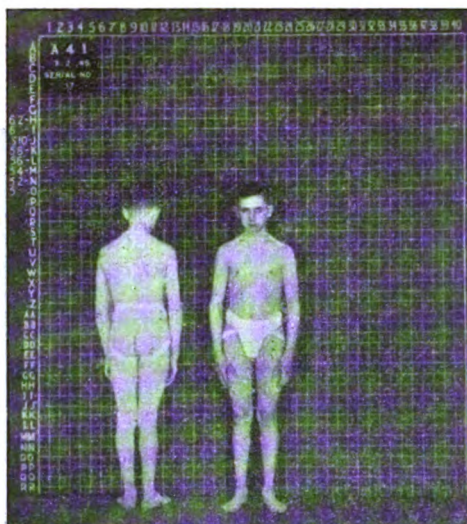


Fig. 8A—1.

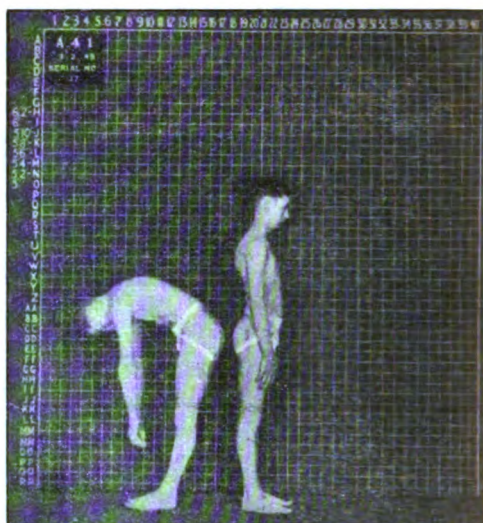


Fig. 8A—2.

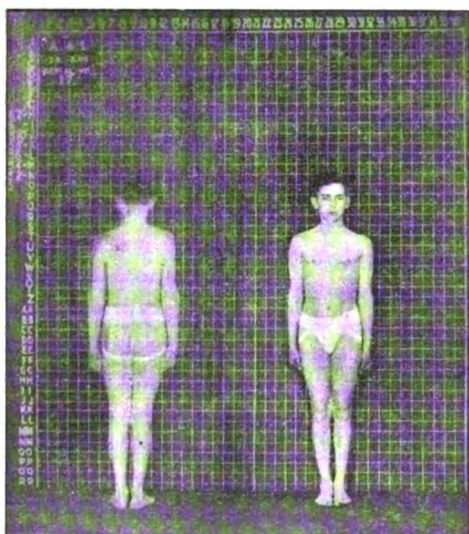


Fig. 8B—1.

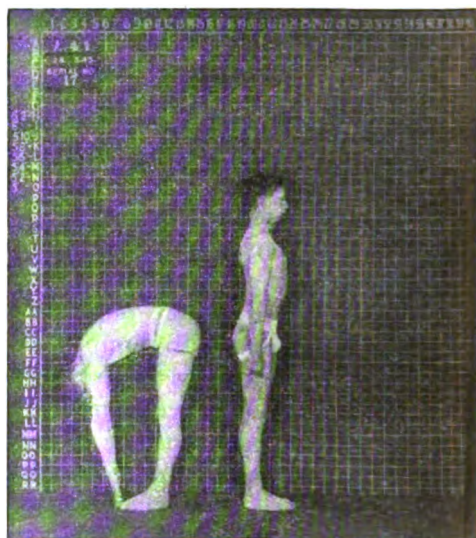


Fig. 8B—2.

amount of time devoted to drill varies from some 14 per cent in the earlier stages to 9 per cent later.

Physical training is of paramount importance and about 17 per cent of training hours is given to this subject. The objects of physical training are to get fit the recruit, keep fit the trained soldier and refit the convalescent. In this connexion invaluable work is done by that splendid Corps of men the Army Physical Training Corps.

Considerable attention is paid to the establishment of a keen interest in physical training in the soldier and of a realization by him that physical training must be combined with the will to be fit.

Modern physical training is essentially purposeful and recreational and the old days of set physical training exercises limited in scope and non-purposeful are over.

Considerable encouragement of interest in P.T. on the part of all medical officers is also effected and special instruction in this subject is given to them. There is also a close association between the Army Corps of Physical Training and the Medical Services, particularly the Hygiene organization.

As the result of physical training we find the recruit at the end of his primary training, exhibiting increased fitness, augmented powers of endurance, a general strengthening of the body, improved control and co-ordination of movement and much greater alertness and quickness of reaction.

Similar results are noted as the result of his Corps training, physical training here being more specialized as the soldier is at his Corps Training Centre equipped for battle. Here special stress is laid on the importance of carrying out tasks with the minimum of effort, and physical training includes such things as rope climbing, obstacle crossing, river crossings and similar activities.

Another feature of importance in health training is education in hygiene. Hygiene in the Army means the attainment, maintenance and enhancement of mental and physical health and efficiency, and the prevention of disease. The recruit and his primary training centre is given special instruction in personal hygiene and at his Corps training centre in communal hygiene. This instruction is to be aided by specially prepared educational films, and by all other practicable means.

General education is of obvious importance to the mental health of the soldier, and this is the responsibility of the Royal Army Educational Corps. Education of this kind occupies about 12 per cent of training time.

The necessity too for education of this nature will be appreciated when it is realized that approximately 26 per cent of the Army intake is below the school leaving standard of elementary schools.

Teaching in citizenship and current affairs is included, as also instruction in regimental history. Special emphasis is laid on moral welfare and instruction in this is a combined responsibility of the C.O. and officers of the unit, together with the education officers, chaplains, doctors, welfare and sports officers all working together as a team.

Finally we must not fail to include what are known as the C.O.s hours. These amount to something like 17 to 20 per cent. of training hours and, in the course of these, talks are given on discipline, comradeship, sense of duty, unity, loyalty, team work and similar subjects.

There are finally, padres' hours for recruits, one a week, in the course of which helpful talks are given by the chaplain.

Time precludes my saying anything further about the recruit and we must turn for a moment to the trained soldier. He still has much to learn. As a recruit he should have imbibed the basic principles of positive health, but

the subject of venereal disease in the Services, that the Army pays attention to this important matter in particular, nor in general to mental and physical fitness in its men.

These are a constant preoccupation of the authorities

on the return of the National Service man to civil life. He spends six years during which time he will be with the Army. In this period there will be an urgent necessity for the Army to attain with the maximum possible degree of efficiency with the maximum possible degree of careful planning. There is no reason why the soldier, as in the past, be an excellent teacher of the crafts of war and with proper direction make a contribution to make to national life. On his return to civil life with a real positive health and how to attain and use it as a propagandist of health in the community. It is noted that, if his benevolent intentions are provided with much encouragement, he can be as effective as is possible.

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For the civil population has a great need of health. It is obvious in view of the increasing demands of a nation in modern war. The Army must integrate their efforts with those of the Services. The Central Council of Physical Recreation is the official co-ordinating body for all sports and other organizations. The Central Council of Physical Recreation does most valuable work and can help considerably. There are also many other organizations which can be of material assistance.

In particular, I would like to mention the necessity for making the fullest use possible of the 3,000 or more officers and men of the Army Corps of Physical Training who have been released since the end of the war. Their full employment would have a most stimulating effect. There is, naturally, also the need for the fullest co-operation on the part of local health authorities and of industry.

In general there is a great need for good long-term planning. In civil life as well as in the Services positive health must be studied. Its full attainment means everything to the nation in the difficult years to come and must be an important factor in our victorious emergence from the present troublous times.

there is still a great deal to be done and he must learn how to put the principles of health into continued practice. Constant supervision and assistance are necessary in this connexion. Physical fitness must be maintained and physical training must be arranged to fit in with other forms of training and the requirements of the individual and the Army.

As regards mental hygiene this requires constant supervision as well as attention to morale. Of particular importance in this regard is the training of officers in man management and hygiene and the interest of unit medical officers. Finally, of much moment is the considerable assistance that is afforded by the Army psychiatric organization.

We have also to remember the question of rehabilitation after sickness and injury and the progress encompassed and the great improvements made in methods of rehabilitation in hospitals and convalescent depots.

We have dealt up to the present with matters very largely from the individual point of view and I would like for a few moments to emphasize the importance of environmental hygiene.

It is essential that the authorities concerned throughout the Army should do everything they can to ensure that there is as satisfactory an environment as possible for all troops. Such an environment is essential to positive health and morale, though its standard must, of course, vary with the conditions in which men are operating. The best possible in any given conditions must be attained.

Accommodation must be looked to whether it is the bivouac shelter for the men in forward areas or whether it is barracks in a peacetime station.

Food from the nutritional point of view wants the most careful attention, as also water supplies, both quantity and quality.

Clothing, equipment, welfare, recreation, education, occupational hygiene and various other matters that go to make up the environment of the soldier all demand the most detailed study, and I would remind you of the very special attention that is paid to personnel research.

Research of this type is the study by physiological, psychological, anatomical and other methods of the best means of increasing the efficiency, safety and comfort under different environments of the soldier, and conversely the adaptation of vehicles, equipment, weapons, etc., to the convenience and capabilities of those who have to use them.

Biological research of this nature is of the very greatest importance and steps to provide for a suitable biological research organization on an inter-Service basis are not being overlooked by the authorities concerned.

In general, hygiene is no longer the prevention of disease and sanitation. Its true concept is being fully realized and accepted throughout the Army, and the Services as a whole, and the need for the application of its principles is becoming more fully appreciated than ever. The medical services in general and their hygiene and psychiatric organizations in particular are doing all they can to help.

It is hoped that my lecture will assist the realization of the Army's efforts to create *mens sana in corpore sano*; also that it will serve to correct the false impression, given to the public in recent utterances and writings in Press and

Parliament on the subject of venereal disease in the Services, that the Army pays little or no attention to this important matter in particular, nor in general to the promotion of mental and physical fitness in its men.

These aims have been and are a constant preoccupation of the authorities concerned.

Let us turn lastly to the return of the National Service man to civil life. He will be in the Reserve for six years during which time he will be with the Territorial Army. During this period there will be an urgent necessity for the maintenance of his military efficiency with the maximum possible degree of mental and physical health. The attainment of these aims within the Territorial Army framework will need careful planning. There is no reason why the Territorial Army should not again, as in the past, be an excellent teacher of citizenship as well as of the arts and crafts of war and with proper direction the Territorial Army will have a valuable contribution to make to national life.

The national service man will, it is hoped, return to civil life with a real knowledge of the great importance of positive health and how to attain and maintain it. It is hoped too that he will be a propagandist of health in the population at large. It must, however, be accepted that, if his benevolent influence is to be exerted to the full, he must be provided with much encouragement and as great a degree of the necessary facilities as is possible.

The peacetime importance of positive health in the civil population has already been alluded to. Its wartime importance is obvious in view of the involvement of the great majority of civilians of a nation in modern war. The civil authorities must therefore integrate their efforts with those of the Services. The Central Council for Physical Recreation is the official co-ordinating body and has affiliations with sports and other organizations. The Central Council for Health Education does most valuable work and can help considerably. There are also many other organizations which can be of material assistance.

In particular, I would like to mention the necessity for making the fullest use possible of the 3,000 or more officers and men of the Army Corps of Physical Training who have been released since the end of the war. Their full employment would have a most stimulating effect. There is, naturally, also the need for the fullest co-operation on the part of local health authorities and of industry.

In general there is a great need for good long-term planning. In civil life as well as in the Services positive health must be studied. Its full attainment means everything to the nation in the difficult years to come and must be an important factor in our victorious emergence from the present troublous times.

INFECTIVE HEPATITIS.

BY

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THE main object of this paper is to record briefly what I believe to be essentially a syringe transmitted outbreak of acute fulminating hepatic necrosis affecting members of the Polish Forces in the British Army of the Rhine and in which 8 cases out of a total of 26 cases treated in my unit recovered. In the first instance I shall mention some of the features of 153 cases of infective hepatitis treated in my unit plus one B.I.D. during the period of the outbreak, i.e. October 1, 1946, to April 30, 1947, and compare the mortality rate with that in B.A.O.R. during the same period, during the period January 1, 1946, to September 30, 1946, and during the entire period January 1, 1946, to April 30, 1947, with reference to the introduction of arsenic in the B.A.O.R. treatment for syphilis on August 1, 1946.

In all large outbreaks of infective hepatitis there is usually a low mortality rate of between 0.13 per cent and 0.44 per cent although mortality rates of 15 per cent are known and high mortality rates have been described in outbreaks of so-called serum jaundice.

Total cases and mortality rates of the periods mentioned in this paper are as follows:—

	<i>Total cases of infective hepatitis</i>	<i>Deaths</i>	<i>Mortality rate per cent</i>	<i>Remarks</i>
<i>B.A.O.R.</i>				
January 1, 1946 to April 30, 1947	1,858	44	2.36	6 British 38 Polish
January 1, 1946 to September 30, 1946	1,257	1	0.079	1 British
October 1, 1946 to April 30, 1947	601	43	7.15	5 British 38 Polish
<i>Brit. Military Hospital</i>				
October 1, 1946 to April 30, 1947	154	19	12.33	19 Polish

Of the 6 British cases one had treatment for V.D. in the U.K. and one in Malta in the preceding six months. Of the remaining 4 British soldiers 2 had had routine inoculations in the preceding six months while the remaining 2 gave no history of any injections whatsoever during the preceding six months.

None of these 6 British cases had any association whatsoever with each other. When I come to describe the high mortality rate amongst the Poles it may be that the high incidence of syphilis amongst them, and the fact that syphilis after August 1, 1946, was treated with arsenic and bismuth in addition to penicillin, is of some significance as regards severity and high mortality rate. In all 38 fatal Polish cases died in two military hospitals—except one who was brought in dead.

Between October 1, 1946, and April 30, 1947, in one British military hospital there were 154 cases of infective hepatitis one of whom was B.I.D. Of these 80 were British and 74 were Polish. 19 cases were fatal giving a mortality rate of 12.33 per cent. The mortality rate amongst the British cases in this series of cases was nil per cent whilst the mortality rate among the Poles was 25.67 per cent. 89 or 57.8 per cent of all cases had treatment with penicillin for some type of venereal disease during the preceding six months. Of these 89 cases: 67 had syphilis; 15 had gonorrhœa; 4 non-specific urethritis; 3 venereal disease (type not specified in the notes).

Of the 67 cases who had treatment for syphilis at least 57 are known to have had arsenic and bismuth therapy in addition to penicillin parenterally which had been exhibited in all 67 cases. All four cases of non-specific urethritis had been treated with penicillin but two cases had arsenotherapy in addition. The remaining 18 cases of venereal disease had penicillin therapy alone. 24 out of the remaining 65 cases of infective hepatitis had had routine protective inoculations during the preceding six months. Of the remainder 1 had penicillin for gingivitis, 1 had repeated hypodermic injections to produce sleep over a period of two weeks, while 2 had venipuncture at a Polish F.D.S. where the majority of fatal Polish cases had treatment for venereal disease. Therefore 117 or 75.98 per cent of all cases of infective hepatitis in this series had injections of some sort within six months of the onset of their illness.

Of the 153 cases treated in hospital: 75 or 49 per cent (approx.) had an enlarged, palpable and tender liver; 19 or 12.41 per cent had splenomegaly; 35 or 22.87 per cent had albuminuria; 20 or 13 per cent (approx.) had cylindruria (granular casts).

The average stay in hospital of 132 cases was 29.76 days. The maximum being 90 days and the minimum being 7 days. One case absconded. The average stay in hospital of 49 recovered cases that had syphilis was 33.08 days, the maximum being 91 days and the minimum being 9 days. Two cases out of 154 were evacuated to the U.K. One had had syphilis and one had not had V.D. but had had a typhus inoculation. All recovered cases who were not evacuated to the United Kingdom were sent to a Rehabilitation Centre for at least two weeks as a routine except the Poles who were sent to their units for a minimum of two to three weeks. All cases were advised against alcohol for six months and against anæsthetics, except in an emergency, for six months as well as against having arsenotherapy or other agents believed to be hepatotoxic. It will be seen therefore that the average case was off duty for a minimum of over six weeks.

Brief Analysis of 19 Fatal Cases of Infective Hepatitis Which Were Dealt With by One British Military Hospital in the Period October 1, 1946 to April

30, 1947.—All 19 cases were Polish. One was brought in dead with a provisional diagnosis of encephalitis while 18 cases died in hospital. One of these cases was admitted to the surgical division as a case of ? perforated gastric ulcer.

Of the 19 cases, and during the preceding six months: 17 had syphilis which had been treated by penicillin, arsenic and bismuth, one had penicillin for "dermatitis" at a Polish F.D.S. in December, 1946, one had venipuncture at the same Polish F.D.S. at which all of these fatal cases, and the majority of other fatal Polish cases elsewhere, including 2 Polish D.P.s, had had injections of some sort but mainly for venereal disease or for blood tests. This fatal case had also had treatment for furunculosis at this F.D.S. He was too ill to tell us if he had had penicillin there.

Of the 17 cases who had syphilis 1 had treatment between November 19, 1946, and February, 1947, whilst the exact dates of treatment of 16 of these cases are known accurately.

Average onset of illness after the first penicillin injection = 90 days. Maximum 133.5 days. Minimum 63½ days.

Average onset of illness after the first arsenic injection was 75.68 days. Maximum 126 days. Minimum 56 days.

One case was first noted one week before the last arsenic injection, one just after the last injection was given while 15 cases were first noted after the completion of arsenical therapy.

15 cases occurred on an average of 21 to 33 days after the last arsenic injection—the maximum being 63 days and the minimum 3 days.

The ages of the fatal Polish cases were 28, 24, 22, 42, 21, 23, 31, 22, 31, 45, 33, 38, 32, NK, 25, 23, 26, 41, and 41 years. Average age = 30.44 years. They received the standard B.A.O.R. therapy for syphilis just as did the British cases of syphilis amongst whom we have had no fatal cases where antisyphilitic treatment was carried out in B.A.O.R. The drugs used, and the dosages given, were exactly the same for everyone.

Infection with *Leptospira icterohæmorrhagica* was excluded in some cases as follows:—

7287 *Nalewaj* (fatal case).—(1) Guinea-pig was inoculated with 2 c.c. whole blood intraperitoneally on the fifth day of the disease. Negative. (2) Dark-ground examination of urine eighth day. Negative. (3) Dark-ground examination of blood from P.M. Negative.

25075 *Milkulka* (recovered case).—Guinea-pig inoculation the first week of the disease. Negative.

Serum Agglutination Tests.

31172 *L/Cpl. Berezowski* (recovered). Admitted 3.3.47 with history of two days' anorexia and nausea. Serum sent to Wellcome Laboratory Trop. Med. on 19.3.47. Agglutination of formalized culture of *Lept. icterohæmorrhagica* (human strain) negative.

26979 *Pte. Kwiecien* (recovered). Admitted agglutination negative on 19.3.47.

Complement-fixation Test.

The Germans have a C.F.T. for Weil's disease which they did in the following cases—all with negative results. *Nalewaj* (fatal). *Ratajczak* (fatal). *Gawlik*, *Kwiecien*, *Karpinski*, *Milkulka*, all relatively severe cases which recovered.

They appeared to be well-nourished men. They received the same basic

ration as the British and their clothes and living conditions were similar to those of the British. However, they were alleged to indulge to a great extent in crude local alcoholic liquors and not to observe any restrictions on their mode of life during their out-patient antisypilitic treatment. Average duration of the fatal illness before admission to hospital in 17 fatal cases, 6·41 days. Maximum eleven days. Minimum four days.

Average duration of illness in hospital before fatal issue ensued, 1·58 days. Maximum four days. Minimum five minutes.

One patient was B.I.D., 1 died in five minutes, 10 died in twenty-four hours, 4 died in forty-eight hours, 1 died in two and a half days and 2 died in four days after admission to hospital.

The average duration of the entire illness in 17 cases was 8·03 days, the maximum duration being fifteen days and the minimum five days.

Of 18 cases dying in hospital the spleen was felt in 4 cases and the liver in 14 cases on admission while 6 had albuminuria and 2 cylindruria (granular casts).

Tyrosine crystals were found in the urine in some cases—the exact number I cannot state—and in at least one of these cases the patient recovered. All cases dying in hospital normally showed, on admission, severe toxic symptoms and prostration, minimal icterus—noted essentially on the conjunctivæ—and normal urine in the majority of cases except for albuminuria and cylindruria (granular casts in 2 cases). Bile eventually appeared in the urine in every case and the degree of icterus in the soft tissues became rapidly and progressively deeper. The relatively slight degree of bilirubinuria at death in these cases compared with the ultimate deep bile staining of the soft tissues would appear to be an index of the degree of acute fulminating massive hepatic necrosis leaving few hepatic cells capable of dealing with bilirubin.

Accordingly there would be very little "Post-liver cell bilirubin" regurgitated into the blood in these cases as compared with "Pre-liver cell bilirubin" and of course the renal threshold of the latter is very high whilst that of the former is low. In this connexion it is noteworthy that all the S.I.L./D.I.L. cases in this series of profound prostrating infective hepatitis who recovered, i.e. 8 out of 26 or 30·8 per cent of those treated in hospital, soon developed deeply bile-stained urine in addition to deep icterus of the soft tissues. This state of affairs appeared to indicate a less extensive hepatic necrosis in these cases and relatively speaking the prognosis in such cases was regarded as being less grave and with hope of recovery. All cases had marked anorexia and nausea while practically all cases had vomiting in varying degree. At least 3 had severe hæmatemesis.

The average total white blood cell count in 13 fatal cases was 10,555/c.mm. Maximum 18,500/c.mm. Minimum 5,000/c.mm.

The majority of cases exhibited a maniacal pre-comatose phase. In this connexion the findings on examination of the brain at autopsy are of interest.

In 3 cases the brain and meninges were not examined. Cerebral œdema was noted in 10 cases and in 9 of these a *pressure cone* was described. In 6 cases no evidence of cerebral œdema was recorded but it is freely admitted that at the early autopsies evidence of cerebral œdema was not especially sought for and so it is reasonable to suggest that it was overlooked in some cases if not in all cases.

However, cerebral oedema was obvious in 10 out of 16 cases examined, i.e. 63 per cent approx. Another point of significance was that oedema of the brain was most marked in the patient who was brought in dead with a provisional diagnosis of encephalitis. This is important as he had received no special treatment for his condition.

It is suggested that the cerebral oedema, which it is felt must be present in varying degree in all such cases, is the cause of the late—usually terminal—neurological manifestations presented by similar cases and would appear to be the most likely explanation for the maniacal precomatose phase exhibited by almost all fatal cases in this series and in all previous cases seen by me.

The attitude of the majority and their response to external stimuli reminded me forcibly of the attitude and conduct of patients with “cerebral irritation” subsequent to cerebral trauma. They would be quiet for a time lying on one side and in an attitude of general flexion with the eyes closed. They would resist all attempts to open their eyes or any form of treatment or examination. All external stimuli such as a touch would be accompanied by vigorous acts of resistance both vocal and physical. Evidence of papilloedema was searched for in some cases but never demonstrated. Lumbar puncture in 2 cases revealed increased pressure of the cerebral spinal fluid but this was normal in another case. There was never any typical cerebral vomiting.

Post-mortem appearances in the liver showed massive hepatic necrosis—the necrotic zones appeared to be surrounded by a narrow rim of liver tissue.

The average weight of the liver in 18 cases was 1,166 grammes: Maximum 1,485 grammes; minimum 840 grammes; normal 1,600 grammes.

The average weight of the spleen in 14 cases was 224·64 grammes: Maximum 310 grammes; minimum 90 grammes; normal 170 grammes.

Other findings were: Petechial hæmorrhages (subcutaneous, subpericardial, subendocardial, intramural, subpleural, intrapulmonary, under gastric mucosa, lower end of œsophagus, under duodenal mucosa). Dilated vessels and oozing of blood at lower end of œsophagus and at cardio-œsophageal junction. Epistaxis and hæmatemesis. “Coffee grounds” material was found in the stomach in at least 17 cases. Marked icterus of the body tissues. In some cases the kidneys were obviously swollen. Enlarged mesenteric glands were observed in a few cases.

Of the 19 fatal cases described here: 5 died between October 5, 1946, and October 22, 1946; 4 died between December 12, 1946, and December 19, 1946; 1 died on January 28, 1947; 3 died between February 11, 1947, and February 28, 1947; 5 died between March 3, 1947, and March 21, 1947; 1 died on April 15, 1947.

Of 36 fatal Polish cases in B.A.O.R. October 1, 1946, to April 30, 1947: 8 died in October, 1946; 2 died in November, 1946; 12 died in December, 1946; 1 died in January, 1947; 7 died in February, 1947; 5 died in March, 1947; 1 died in April, 1947.

Of the 38 fatal Polish cases in B.A.O.R. it is known with certainty that at least 32 had syphilis and that one had gonorrhœa and probably syphilis as well while one had penicillin for dermatitis and one had venipuncture all at the same

F.D.S. There remain only 3 cases concerning whom we have no information as to whether or not they had V.D. or injections of any sort at the Polish F.D.S.

At this point it may be worth repeating that prior to August 1, 1946, syphilis was treated with penicillin whilst after that date arsenic and bismuth were exhibited in addition.

TREATMENT.

In all cases of infective hepatitis in which the patient did not suffer from anorexia or nausea they were given plenty to eat on the lines of a high carbohydrate, high protein, high vitamin, high calorie and restricted fat diet—six compound vitamin tablets were also given daily, as well as one teaspoonful of sodium bicarbonate thrice daily. A saline aperient was given when necessary but routine aperients were avoided as was calomel and similar relics of the past. In cases with anorexia and nausea the diet was essentially fluid and on the above principles. Casein hydrolysate, glucose and skim milk were given as œsophageal feeds by the continuous drip method. When there was much retching and vomiting this treatment was not possible. On such occasions the patients were given 100 c.c. of 40 per cent glucose or 30 per cent dextrose intravenously twice daily and a slow continuous intravenous drip using 5 per cent glucose saline and plasma separately—two pints of the latter were given in twenty-four hours. Insulin 5 to 10 units daily was given hypodermically in some cases.

Injections of vitamin K were also given in cases with hæmorrhages or with a hæmorrhagic tendency but it is appreciated that in cases where the hæmorrhagic tendency was the result of destruction of liver parenchyma it was presumably a waste of vitamin K. Restless and noisy cases were given paraldehyde 3j to 3ij intramuscularly and repeated in one hour if necessary. It seems to be the safest drug to give in the presence of liver damage.

DISCUSSION.

Before the beginning of the second German war infective hepatitis was known by the majority as catarrhal jaundice and very little was known about this condition. Since then we have gained in knowledge and our conception of the pathology involved has altered. Experience of this global disease has suggested that the disease may be spread by droplet infection with an incubation period of thirty days or so, that it may be spread by dust in the air in a dusty environment where the ground is polluted by fæces and urine infected by the virus of infective hepatitis or by decomposing bodies infected with the virus of infective hepatitis as happened at El Alamein in the Western Desert of Egypt, before Keren and elsewhere. In Eritrea numerous troops told me that they thought the disease had something to do with decomposing bodies and with the filthy water which they had to drink and which they drank so frequently without sterilizing. Not unnaturally it has been suggested that filthy fæcal flies play a part in the spread of the disease and if they do then why not water also? The fact that officers do drink water to slake their thirst while the soldiers drink tea may be one reason why the incidence of this disease is said to be greater in officers than in the other ranks.

The disease has been transmitted to volunteers by injections of serum from

proven cases, by feeding infected *fæces* to human volunteers and by instillation of nasal washings from active cases. The virus has also been demonstrated in bile in infected cases and also in the urine. Biting flies and blood-sucking insects have also been suspected of spreading the disease.

Explosive outbreaks of this disease have also occurred in individuals receiving treatment or investigations in arthritis clinics, diabetic clinics and V.D. clinics, etc., as well as in cases receiving protective vaccines, which have been known to contain a small fraction of human (pooled) serum (infected), and in individuals who have received convalescent serum (measles and mumps).

It has been shown that human serum may contain the virus of infective hepatitis whether or not the patient has infective hepatitis and that this virus is most viable. It has also been shown that during all injections especially in intravenous injections not only the needle but the syringe may become infected with the virus of infective hepatitis and that unless special care is taken the needle and/or syringe remains infected with the virus of infective hepatitis. In this way further use of infected needles and syringes, especially in intravenous therapy, may, can and does result in the transmission of infective hepatitis directly to other cases. The incubation period in such cases is believed to be anything between two to four months but may be anything from one to six and a half months or so. The reason for the long average incubation period is believed to be due to the fact that a small quantity of antibody is injected with the virus of infective hepatitis and that it is eventually "diluted out" and so liberates the virus to produce its effects.

This is an age of injections and in my extensive experience of this disease in Egypt, the Anglo-Egyptian Sudan, Eritrea, Syria, Palestine, the United Kingdom, Belgium, and Germany the disease would appear to have altered its characters somewhat.

It appears to me to be less benign than formerly. In my experience in the Middle East it was essentially a disease with a febrile onset yet in B.L.A. and B.A.O.R. in my experience an afebrile onset seems to be the order of the day. These differences may well be due to the fact that a high percentage of infective hepatitis seen in this theatre is syringe transmitted and in such cases an afebrile onset appears to be frequent. There would appear to be no doubt that the fatal cases described by me in this paper all suffered from syringe transmitted infective hepatitis and that the source of infection was a Polish F.D.S. Only in one of the 8 non-fatal cases in this series of 27 cases—18 of which were fatal in hospital and one out of hospital—was a history of an injection of some sort at this Polish F.D.S. not obtained. Some authorities believe that highly virulent syringe-transmitted jaundice may be further transmitted by other means so that may be the explanation in that one case. There is no difficulty in accepting that explanation.

In some cases it may be that the high mortality rate was predisposed to by the hepatotoxic effects of syphilis and arsenic. It has also been suggested that the virus of infective hepatitis and arsenic have a synergic action.

What part if any does penicillin play in facilitating the pathogenic effects of the virus of infective hepatitis and/or the toxic effects of arsenic?

Major R. M. Henderson, R.A.M.C., Dermatologist, is much impressed by the high incidence of arsenical dermatitis, arsenical reactions and cutaneous reactions to penicillin these days. Does penicillin facilitate in some way the toxic effects of arsenic and/or the pathogenic action of the virus of infective hepatitis? These points are worth considering. What is the correct diagnosis in all these cases? Is it infective hepatitis or syringe-transmitted jaundice or post-injection infective hepatitis? The diagnosis could equally well be post-arsphenamine jaundice in some cases or homologous serum jaundice.

Are not all these just names for infective hepatitis, the virus of which may enter the body, or be introduced into the body, through different routes and in different media which may affect its virulence? Are not all these names just synonyms for infective hepatitis?

Witts in his excellent "Review of the Dietetic Factors in Liver Disease" speaks of there being a high fatality rate in post-arsphenamine jaundice as compared with infective hepatitis. If there is a distinct disease called post-arsphenamine jaundice then why not post-penicillin jaundice, post-venipuncture jaundice, post-serum jaundice, etc.? Surely they are all just synonyms for infective hepatitis with a mortality rate and clinical severity varying with the presence of coincident pathology in the body, the mode of entry of the virus into the body, the virulence of the particular virus and the nature of the medium surrounding it and injected into the body with it as well as on the resistance of the individual? Authorities in this disease by their utterances in public and in private as well as by their publications in the Medical Press give the impression that they are not prepared to say that the infecting agent in infective hepatitis, homologous serum jaundice, and post-arsphenamine jaundice, etc., is the same and all tend to speak of them as separate, though maybe associated, entities. Yet the pathological changes in the liver as studied by liver biopsy are said to be similar if not the same in all three so-called different conditions. 17 of the 19 fatal cases described by me had syphilis and had arsenotherapy as well as penicillin and bismuth. Of 154 cases of infective hepatitis 89 or 58.44 per cent had treatment with penicillin for V.D. and of these 59 at least had arsenic as well as penicillin. Surely syringe-transmitted infective hepatitis is the diagnosis in these 89 cases?

When out of 154 cases 93 or 60.38 per cent had injection therapy or I.V. injections of some sort (89 V.D., 1 penicillin for gingivitis, 2 venipuncture and 1 repeated hypod. hypnotic injections) and 117 or 75.98 per cent have had injections of some sort during the preceding six months the vital importance of adequate sterilization of all needles, syringes and of all apparatus in which materials for injections are stored or pass through *en route* to the human body is made manifest. In addition needles and syringes which have been used in jaundice cases should never be used for other cases even in the presence of adequate sterilization.

Numerous papers on clinic jaundice or syringe-transmitted jaundice have appeared in the literature and this series merely repeats and emphasizes what has been said before.

The 27 cases of grossly severe and fulminating infective hepatitis would appear to be similar to the fulminant form of epidemic hepatitis described by

Lucké and Mallory. I wonder if a recovery rate of 30·8 per cent was due to good luck or good management. I favour the former although the latter may have had something to do with some of the recoveries. Is it possible that the virus of infective hepatitis is becoming increasingly virulent because of passage?

The gross pathology presents features of outstanding interest, namely the gross hepatic necrosis and the obvious gross cerebral oedema which was observed in all cases in which the brain was examined closely. The reason for the maniacal phase with subsequent coma was now apparent. Some of the livers showed great diminution in size with wrinkled capsule, subcapsular hæmorrhages and gross destruction of liver parenchyma with scarcely any regeneration. Some of the livers which did not appear to be obviously reduced in size on macroscopic examination showed extensive hepatic necrosis on section with just a narrow rim of liver tissue at the periphery. The fact that the epidemic of fulminating hepatic necrosis involved essentially the Polish Forces of the British Army of the Rhine and that fatal cases treated in my unit had had injections at a certain Polish F.D.S. would appear to be proof positive that we were dealing with syringe-transmitted infective hepatitis due to a virus of enhanced virulence.

It may be that we have not seen the end of this fulminating and highly fatal type of infective hepatitis in Europe. One thing that all of us can do is to ensure that all syringes and needles, etc., receive adequate sterilization after use in every case, and that jaundice cases should have needles and syringes used exclusively for jaundice cases with adequate cleaning and sterilization after use.

SUMMARY.

An outbreak of fulminating hepatic necrosis affecting essentially soldiers of the Polish Forces of the British Army of the Rhine and with 38 fatal cases has been mentioned. Features of 19 fatal cases out of a total of 27 cases of this type dealt with by one British Military Hospital have been outlined briefly. The possible part played by syphilis—at least 32 cases out of the total of 38 fatal cases are known with certainty to have had syphilis—and anti-syphilitic therapy in the severity of these cases and the likelihood of syringe-transmission of the disease is suggested.

Out of 154 cases of infective hepatitis dealt with in one British Military Hospital during the outbreak of fulminating hepatic necrosis the high incidence of venereal disease, i.e. 89 cases or 58·44 per cent amongst them, the high incidence of injection therapy, i.e. 93 or 60·38 per cent amongst them, and the fact that 117 or 75·98 per cent had injections of some sort during the preceding six months is stressed. Out of the 38 fatal Polish cases 32 had syphilis, one had gonorrhœa and ? also syphilis, one had penicillin for dermatitis, one had venipuncture at the suspected Polish F.D.S. and ? penicillin for furunculosis while details of the remaining 3 fatal Polish cases are unknown.

The mortality rates over three periods in the British Army of the Rhine are contrasted, i.e. January 1, 1946, to April 30, 1947, October 1, 1946, to April 30, 1947, i.e. the period of the outbreak and January 1, 1946, to September 30, 1946. Out of 26 cases of the fulminating form of hepatic necrosis treated in one hospital 30·8 per cent recovered.

The facts, that arsenic and bismuth were used in addition to penicillin in the treatment of syphilis in B.A.O.R. from August 1, 1946, that fatal cases from this fulminating form of hepatic necrosis amongst the Poles began in October, 1946, i.e. at least two months later and that the outbreak predominantly affected syphilitics (32 at least of the fatal cases), that at least 2 other fatal cases had injections (penicillin with or without arsenic and bismuth) in the Polish F.D.S. where outpatient anti-syphilitic treatment was carried out and one other had a venipuncture, would appear to be of great significance as regards severity and ætiology of the disease.

The presence of obvious cerebral œdema in the majority of the brains is emphasized and its significance discussed.

The need for adequate sterilization of all needles and syringes used in protective inoculations and in the transmission of all fluids into the human body is of vital importance.

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Clinical and Other Notes.

**TABES DORSALIS, AORTIC ANEURISM, AND
CUTANEOUS SYPHILIS PRESENTING IN THE
SAME PATIENT.**

BY

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[Received October 24, 1947]

THE simultaneous existence of tabes dorsalis, aortic aneurism, and nodular cutaneous syphilis is considered to be of sufficient rarity and interest for the case described below to be worthy of record. For while it is most improbable that this combination has not been described before, a thorough search of the available literature has failed to find any reference to this.

The combination of cardiovascular and cerebrospinal syphilis is much more common than was supposed to be the case early in the present century. Holger Buch (1945) quotes Berger, Rosenbach, Ruge Huthner, Rogge Muller, and Stadler as stating that cardiovascular lesions were complicated by tabes in only 4 to 10 per cent of cases, whereas later figures proved to be considerably higher. Moore, Danglade and Reisinger are quoted as having found syphilitic skin lesions in 2.5 per cent of patients with aortic aneurism. Cole and Usilton (1936) from observation of a series of cases of syphilitic aortitis state that concomitant involvement of the skin is rare, i.e. 4 per cent of cases, and that the most frequent co-existent involvement noted by them was cerebrospinal syphilis—45 per cent of cases—25 per cent parenchymatous. It was also observed that concomitant syphilis of the central nervous system in cases of aortitis with aneurism was parenchymatous in nearly all instances. Skin involvement and aortic aneurism only occurred together in one patient of their series.

The patient, a Service man, 37 years of age, married, with two children (boy, 10 years, and girl, 3 years) was referred to the Special Treatment Centre at this hospital on April 22, 1947. He had a history of having had a rash for some years, recently the W.R. had been found to be positive, and on further examination by X-ray it had been discovered that there was dilatation of the aortic arch. The patient stated that he had always led a strenuous life, and also played games regularly. His work had been very hard physically since the age of 19, but for the last two and a half years, as he had been directing operations, he had been in a position to avoid actual exertion. This fact he had taken advantage of, as he had found that recently he tired more easily.

He had always been perfectly fit and well until four years ago, when in India he started to have attacks of "palpitations" at irregular intervals of about two months. Each attack commences with palpitation, followed by a feeling of constriction of the chest and pain over the præcordium, and finally a feeling of faintness, but no loss of consciousness. The attack is followed by intense frontal headache and a "tired feeling."

Both exertion and excitement seem to precipitate these attacks, which have continued with much the same periodicity and severity until the present time.

At about the same time as the above symptoms commenced, he states that he began to wake up at night to find that he had either voided urine, or had the desire to micturate, and was unable to hold his urine until he could reach the latrine. His records show that on three occasions during 1943 he was investigated for ? cystitis, and in June, 1946, was treated for an attack of *B. coli* cystitis. These urinary symptoms have occurred on and off irregularly up to the present time. His urine had been repeatedly examined during the last few months, but no abnormality had been noted. No history suggestive of lightning pains or impairment of sexual function could be elicited.

In India during May, 1945, the patient stated that he broke out in a rash over the face, forehead, axillæ, right shoulder and upper arm. He described the rash as being scaly and circinate in character. According to records the condition was diagnosed as *tinea corporis*, but fungus was not found in scrapings from the lesions. There was no record of a Wassermann reaction or Kahn test having been carried out. He was treated with fungicidal preparations, both as an in-patient and an out-patient, and by August, 1946, all areas had cleared except those on the right shoulder and upper arm. These areas failed to heal in spite of repeated treatment, and his return to England, he states.

The patient has denied all history at all suggestive of his having had venereal disease. But he admits to having "taken possible risks on occasion, but with precaution" prior to his marriage twelve years ago.

As regards family history, the patient states that his mother died when he was 2 years old—cause of death unknown. He himself was the fifth child of the marriage—two brothers died before he was born, one at under 1 year of age, and the other at under 2 years of age, cause of death unknown. The patient has two older sisters—born in 1903 and 1906 respectively, both of whom are alive, and he thinks in good health. His father is in good health aged 83. As regards the patient's wife and children, there is nothing suggestive of a past or present luetic infection, from either history or physical examination, and repeated W.R. and Kahn tests have been negative.

When first seen the patient was a well-nourished man. His speech was normal and there were no apparent mental changes. His gait was somewhat unsteady, especially on turning. On examination there was some suggestions of frontal bossing, flattening of the malar regions, and a suspicion of rhagâdes at the angles of the mouth. The hard palate had a narrow high arch. There were two small round brownish-red nodules each about 1/3 inch in diameter on the right side of the chin, which the patient stated had been present for the last three months.

On the front of the right shoulder there were two typical annular syphilitic lesions covering an area of about 3 inches in diameter, and there was one similar lesion about 1 inch in diameter on the middle of the lateral aspect of the right arm. Each of these lesions consisted of a circle of small brownish-red nodules. Repeated dark-ground examinations of scrapings failed to show *T. pallidum*.

The clavicles and tibiæ appeared normal, and X-ray examination revealed no abnormality. The pulse was 80 and regular. The blood-pressure was 110/80 mm.Hg in both arms. On percussion, the area of cardiac dullness at the second interspace extended 2 inches to the right of the sternal margin. On auscultation the aortic second sound was found to be markedly accentuated. X-ray of the heart and vessels showed a medium-sized aneurismal dilatation of the ascending aorta commencing close to the aortic ring and exhibiting forcible pulsation.

The pupils reacted sluggishly to light, otherwise the cranial nerves were normal. The optic discs were normal. The abdominal reflexes were present, but all deep reflexes were absent. Plantar reflexes gave a flexor response. There was a loss of appreciation of light touch, and of sensibility to superficial pain over both shins. There was loss of sensation of pain on deep pressure in both tendo Achillis and calf muscles. There was no loss of vibration sense. Rombergism was marked and the gait unsteady, otherwise co-ordination was normal. Motor power was normal.

The blood Wassermann reaction was found to be positive (confirmed), and the quantitative Kahn test 10 Kahn units. The cerebrospinal fluid was clear and not under pressure. Laboratory examination of the cerebrospinal fluid showed: Cells 1 per c.mm. Protein 40 mg. per 100 c.c. Globulin slightly increased. Lange normal. W.R. positive.

In view of the possibility of a Herxheimer reaction, the patient was first given weekly intramuscular injections of 0.2 gramme bismuth before commencing penicillin, and the cutaneous lesions of the face, right shoulder and arm at once began to heal rapidly. During the early part of treatment he had an exacerbation of the urinary symptoms previously described, and *B. coli* were cultured from the urine. The infection responded to sulphonamides.

COMMENT.

This case shows two interesting features. The patient when first seen was found to be suffering from an annular cutaneous syphilide, an aneurism of the ascending aorta, and tabes dorsalis. Judging from the history, it would appear to be possible that the tabetic symptoms and the symptoms referable to the aneurism appeared almost simultaneously, and the cutaneous lesions appeared about twelve months later.

While it is impossible to be certain that this is not a case of acquired lues, the family history, the absence of any previous lesions, the slender but suggestive evidence of facial appearance, and the fact that the disease was not transmitted to the patient's wife and children would all suggest that the infection might possibly be congenital in origin. Unfortunately, the other members of the family could not be examined, and so further confirmatory evidence is lacking.

ACKNOWLEDGMENT.

I am indebted to Colonel C. O. Shackleton, O.B.E., Officer Commanding, Royal Herbert Hospital, Woolwich, for permission to publish the case report.

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LICHEN PLANUS LINEARIS.

BY

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[Received September 9, 1947.]

THE following case of lichen planus linearis in an African soldier had some unusual features.

Case-history.—Private K., aged 23, of normal physique and temperament, stated that at the end of March, 1943, he developed fever with malaise and nausea but no vomiting, and accompanied by generalized pruritus, day and night. After one week, the fever subsided, but coincidentally a rash with linear distribution appeared on the left of the

thorax and a fortnight later it extended to the left arm and forearm. One week after that, discrete lesions appeared on the penis, and one week later still on both legs, left thigh, and right forearm. With the appearance of the rash, pruritus disappeared during the day, but it recurred regularly at night (when he was in bed).

For one month from the time of onset of the fever there was a generalized soreness in his mouth.

On June 30 the rash was still fully developed. It was distributed in two groups as follows:—

(a) As a curved narrow line extending first from a point one fingerbreadth to the



left of the left sternal border at the level of the second left intercostal space up to a point 1 inch below the middle of the left clavicle, then across the anterior fold of the axilla to the middle of the anterior border of the deltoid, and then down the middle of the anterior aspect of the arm and forearm to within two inches of the wrist. It consisted essentially of two lichen manifestations, discrete irregularly-shaped papules, $1/16$ to $1/8$ inch in diameter, and plaques half an inch wide and of variable length, forming small discrete squares or oblongs or large irregularly shaped areas of roughly oblong shape, with their longer axis in the general direction of the band. The larger confluent areas were confined to the arm and forearm.

(b) As scattered papules on the distal 2 inches of the left forearm, including the

wrist, and on the left palm, on all the anterior aspect of the right forearm and on the dorsum of the right hand. There were a few papules on the shaft of the penis, more on the anterior aspect of the thighs, on the medial aspect and dorsum of the knees and a few on the calves.

Some areas on the left arm and forearm were macules only, not rising above the level of the surrounding skin. The colour was throughout burnished dense black, except for the smallest papules, which were white. (The black lesions, due to their sheen or burnish, appear white in the photograph.)

There were a few white papules on the inner surface of the cheeks opposite the third molars and on the soft palate.

Wickham's striæ were not seen.

The lesions were tender on firm pressure; they were not indurated.

He was afebrile throughout his stay in hospital. The circulatory system, lungs, alimentary tract, and C.N.S. were normal. The spleen and liver were not palpable, and there were no abnormal glands. B.P. 120/66. The urine was normal; reaction alkaline. Stool, ova of *Ascaris lumbricoides* seen. Blood Kahn negative. C.S.F. (1.7.43) normal. W.B.C. (30.6.43) 8,200. P. 42 per cent, E. 13 per cent, B. 1 per cent, L. 41 per cent, M. 3 per cent (300 cells counted). Santonin gr. iii was given on 22.7.43, and two round-worms were passed on the following day. The differential count on 29.7.43 (220 cells counted) was P. 45 per cent, E. 7 per cent, L. 44 per cent, M. 4 per cent. On 4.8.43 the stools were negative for ova.

A course of sulphostab was initiated, but at the end of August when he was transferred to another hospital his condition was unchanged.

Differential Diagnosis.—*Linear nævus* (ichthyosis hystrix), whose distribution may resemble that of lichen planus linearis, is readily distinguished by its being a congenital and permanent malformation, appearing as a rule soon after birth and evolving slowly, whereas lichen planus linearis occurs usually in adult life, the whole extent of the lesions developing simultaneously (Macleod, 1933).

Morphœa (circumscribed sclerodermia) in the rare raised form (Barber, 1936), whose distribution may also resemble that of lichen planus linearis, is distinguished by its slow progress, and in the band type of the disease, the lesions adhere to the underlying structures.

COMMENT.

No improvement followed lumbar puncture, and no ætiological factor could be discovered. The patient was not unduly concerned and was in no way an anxious type; nor was he phlegmatic.

The long linear distribution did not follow the course of any one peripheral nerve. It resembled a case reported by Hallum (1931) where the condition was also linear and commenced at the mid-line over the sacrum, extended to its lateral border, and then down the dorsum of the thigh and leg to the ankle. No theory involving adherence to lines of embryonic fissures and clefts, Head's zones, the course of a peripheral nerve, blood supply or lymph drainage can be evoked to explain the distribution in either case. It is extremely improbable that the linear lesion here followed the course of a scratch mark. It is of interest that, according to MacCormac (1937), lichen planus linearis is seldom associated with other and more characteristic lesions.

The various theories which attempt to account for the distribution of the linear dermatoses are reviewed by Piers (1945), but none as yet explains this particular arrangement.

SUMMARY.

A case of lichen planus linearis with an unusual onset and subsequent features is described and its ætiology briefly discussed.

I am indebted to the D.M.S., India Command, for his permission to forward this case for publication.

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Obituary.

Lieutenant-General Sir HAROLD BEN FAWCUS.

IN Hillingdon on October 24, 1947, Lieutenant-General Sir Harold Ben Fawcus, K.C.B., C.M.G., D.S.O., D.C.L., M.B., Director-General, Army Medical Services, 1929 to 1934, and Director-General, British Red Cross Society, 1934 to 1938. Son of Mr. John Fawcus of South Charlton, Northumberland, he was born there May 20, 1876, and educated at Durham School and Durham University, where he graduated M.B. in 1899. He played both cricket and football for the University for five years, and he was also in Durham County XV and the Northumberland XV. Joining at Netley on probation on March 1, 1900, he was commissioned Lieutenant R.A.M.C. April 25, 1900. Promoted Captain April 25, 1903. At the examination for promotion to Major, he obtained a first class certificate entitling him to a year's acceleration of promotion. He was promoted Major April 27, 1911. He was Assistant Professor of Hygiene, R.A.M. College January 1, 1912, to February 28, 1914, and Instructor Army School of Sanitation March 1, 1914, till August 4, 1914. Promoted Lieutenant-Colonel March 1, 1915, Brevet-Colonel June 3, 1919, Colonel June 1, 1926, Major-General October 27, 1926, and Lieutenant-General on his being appointed Director-General September 16, 1929, he retired March 1, 1934, when he was appointed Director-General, British Red Cross Society, which appointment he held till 1938. He was an A.D.G. at the War Office July 1, 1922, till June 2, 1926. He was appointed V.H.S. March 1, 1920, and K.H.P. January 1, 1923. Created C.B. June 3, 1928, and K.C.B. 1931. He was Colonel Commandant R.A.M.C. August 9, 1937, till August 7, 1941. He was a Commissioner of the Royal Hospital, Chelsea. In South Africa 1900-1902, he took part in the operations in Natal, Cape Colony, Orange Free State and Transvaal, receiving the Queen's Medal with four Clasps and the King's Medal with two Clasps. He served in France from August 9, 1914, till April 1, 1919. Six times mentioned in despatches, he was created C.M.G., and awarded the D.S.O., French War Cross, 1914 Star and Clasp, British War and Victory Medals. He again saw

service on the North-West Frontier of India in the third Afghan War in 1919, receiving the Medal with Clasp.

He was the sponsor of the scheme to increase the professional opportunities of R.A.M.C. Officers, to revise the status of the R.A.M. College and to improve the professional side of the Corps, which was only carried through because by its introduction there was no increase of cost to the State.

Major-General H. P. W. BARROW, C.B., C.M.G., D.S.O., O.B.E., writes :—

I am certain that most of us when we read the obituary notice of General Fawcus in *The Times* felt that something of a more intimate nature should appear than the inevitable notice in the *Corps News & Gazette*, hence this appreciation.

As a Corps we have lost another distinguished Officer, and, as individuals many of us have lost a valued personal friend, and I am sure that even those who served under, but rarely came in contact with, him recognize the fact that they have lost one who took a real interest in all their activities in the Corps.

His contemporaries knew him as a man who had a particularly sane mind in a healthy body, a true sportsman in the best sense of that word, and one who had the happy knack of playing nearly all ball games extremely well without any apparent effort, and who with it all was as modest as he was proved courageous and capable.

Younger Officers probably remember him best as the quiet, friendly and good-looking Director-General who, from a very low handicap consistently won competitions at Corps Golf Meetings.

The Corps, generally, will always remember him as the Director-General who was fortunate enough to be called upon to sponsor the scheme which has increased the professional opportunities of Officers, etc., not the least of the three important measures of the last half-century which have made our service the magnificent one it is to-day.

At the examination for promotion to Major (in 1907) he obtained a first-class certificate entitling him to a year's acceleration of promotion—this will convey little to those now serving, but it is significant that up to that time only two Officers had achieved that distinction. At the same time he obtained a special certificate in State Medicine, and that together with the Diploma of Public Health, obtained in 1905, gave him his first opportunity of experience in administration, when he was appointed to the Army School of Sanitation at Aldershot, immediately prior to the War 1914-18. During this War he first made his mark as an administrator when Assistant to the D.M.S. 4th Army. It was only later that he succeeded Colonel (now Lieutenant-General Sir John) Goodwin as A.D.M.S. Guards Division. It says a great deal for his personality and administrative ability and courage that he was able successfully to follow one who was considered by most of us the most able and successful A.D.M.S. Division, in the B.E.F. He was extremely popular with and respected by all ranks of the Corps in the Division.

While at Quetta, upon several occasions he was called upon to lecture on Medical administration to the Officers at the Staff College, and, although he

always found lecturing difficult, I have heard from many Officers how lucid and simply stated and valuable his lectures were.

On returning from India he had the invaluable experience for a future Director-General of holding the appointment of A.D.G., thus dealing with all matters affecting personnel of the Corps.

He had no mean prowess as a cricketer and represented the Army against the Navy at Lords in 1909, 1913 and 1914.

In the first two of these matches his bowling was largely instrumental in the victory of the Army. In 1909 he took seven wickets for sixty-eight runs in the course of the match.

In 1913 he took five wickets for eleven runs in the first innings and four wickets for twenty-one runs in the second innings much to the detriment of the match as a social function.

He played much Club Cricket around London and was a Member of the Free Foresters Cricket Club.

Most Officers of the Corps will remember him as a golfer of distinction. Whilst he was Director-General he won the General's Cup in the Army Golf Championship meeting at Sandwich in 1931 and he played for several years in the Match Admirals v. Generals, and his success in Corps meetings has already been referred to.

He was Captain of the Roehampton Golf Club, and during that year had the distinction of winning his own (the Captain's) Cup at its Championship meeting, and in doing so did a hole in one!

These are a few of the attributes of the friend whose passing the Corps deplores. R.I.P.

Brigadier GEORGE RIDDOCH.

It is with the deepest regret that we record the recent death of Brigadier George Riddoch, M.D., F.R.C.P., Consultant Neurologist to the Army. His association with the Royal Army Medical Corps started during the war of 1914-1918, when he laid the foundation of his brilliant career as a Neurologist. In the recent war he was Consultant in Neurology in which capacity he devoted his knowledge, experience and driving energy to the Service and to his patients.

He worked in very close association with Sir Hugh Cairns in the Head Injury Hospital at Oxford.

The onset of his long and painful illness came with dramatic suddenness. He did not allow the subsequent restrictions placed upon his activities to interfere with what he considered his duty and his devotion to that duty and his burning energy carried him through many hours of pain. He felt deeply that these restrictions prevented his making overseas tours during the war but he did go to Conferences in Paris and Brussels where his alert intelligence and never-failing cheerfulness were both inspiring.

He was a man with many interests, fishing, music, art and literature. His heart was never far from his beloved Aberdeenshire and his knowledge of Scottish lore and Scottish anecdote was extensive. He ever kept a stout heart to a stae brae.

It had been hoped that there were many years of useful work ahead of him as a practising neurologist and as a teacher of the young in which he set exacting standards.

However, it was not to be and another of the flowers of the forest has gone from us. He will live long in the memories of those who knew and loved him.

Brigadier WALTER ROWLEY BRISTOW.

THE death of Brigadier Walter Rowley Bristow, F.R.C.S., *Chevalier Legion d'Honneur, Croix de Guerre avec Palme*, Consulting Orthopædic Surgeon to the Army, has removed from us one who will long be remembered by all who came into contact with him. In the war of 1914-1918 he saw considerable overseas service. In the recent war he served as Consulting Orthopædic Surgeon. He brought to this work a youthful freshness of energy and interest which infected all who worked with him. Essentially practical in his surgical outlook he did a very great service to the Army and became respected and loved by his colleagues and a name to conjure with among his patients.

He loved life in all its aspects and had many and varied interests, but his orthopædic work came before all else.

We owe him a great debt of gratitude.

These two, George Riddoch and Rowley Bristow, amongst their other activities, were members of the War Office Medical Board.

George was for a long time the permanent Neurological member. His experience and sound judgment were invaluable while his never-failing sense of humour and his sympathy with human frailties endeared him to the colleagues who were privileged to work with him. It was while actually sitting as a member of the Board that the first acute attack of his illness took place.

Rowley did not attend so often but, when he did, his advice was always practical and very much to the point. When they were sitting together one saw a perfect example of clinical co-operation and professional harmony.

Both loved life and they both saw that which was good in their fellow men who loved them. They both considered their patients as human personalities and not as "interesting clinical cases."

One could not have wished for better colleagues and they are sadly missed by one who worked with them through the war years and who considered their work of inestimable value to the Service.

GEORGE WILL.

Notice.

"NORTH PERSIAN FORCES" MEMORIAL MEDAL.

A MEMORIAL TRUST FUND, commemorative of the services of the North Persian Forces in the First World War, was subscribed by Officers of the Royal

Army Medical Corps and Indian Medical Service who served with these Forces.

The memorial takes the form of a silver medal, known as the "North Persian Forces Memorial Medal." It is awarded annually for the best paper on Tropical Medicine or Tropical Hygiene published in any Journal during the twelve months ending December 31 by any Medical Officer, of under twelve years' service, of the Royal Navy, Royal Army Medical Corps, Royal Air Force, Indian Medical Services or of the Colonial Medical Service.

The Titles of any papers on Tropical Medicine or Hygiene, with dates and descriptions of the medical publications in which published, that have been contributed during the year 1947 by Officers of the Royal Army Medical Corps should be forwarded to the Under-Secretary of State for War (A.M.D.7) for the information of the Committee of Management. They must reach the War Office not later than September 15, 1948.

ERRATA.

"MENINGOCOCCAL INFECTIONS IN THE ARMY, 1939-45." *Journal of the Royal Army Medical Corps*, 89, 1, 1.

Under title and note of author should be added "(Received March, 1947)." Before author's name should be added "(Being the Contribution from the Army to the official Medical History of the War)."

Page 2. Lines 22 and 41, "*Neisseria*" should be in italics.

Page 14. Last para, line 7, the words "nephritis in the former and" should be deleted, also the words "in the latter" so that the sentence should read "leading to a diagnosis of diabetic coma."

Page 15. Lines, 1, 21, 32, "*Neisseria*" should be in italics.

Page 16. Last para, under differential diagnosis, line 4, "lymphotic" should read "lymphocytic."

Page 20. Case 4, in the note "A typical" should read "Atypical."

Page 23. Case 15, line 11, "quartan" should read "tertian." Line 13, delete "published in *B.M.J.*"

Page 24. Case 16, in the note "subjungual" should read "subungual."

Page 26. Case 24, line 4, "hæmorrhagic spots" should read "hæmorrhagic spots."

Reviews.

THE DIAGNOSIS OF THE ACUTE ABDOMEN IN RHYME. By Zeta. Published by H. K. Lewis and Co. Ltd. Price 5s. 6d. net.

This is an entertaining little book which sets out to teach and to amuse. Diagnostic points have been skilfully rhymed and if the reader likes his instruction in that form, he will probably get this book.

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References :—Shortage of space precludes list of references, but full documentation may be obtained on application to Clinical Research Dept. 6.E.



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